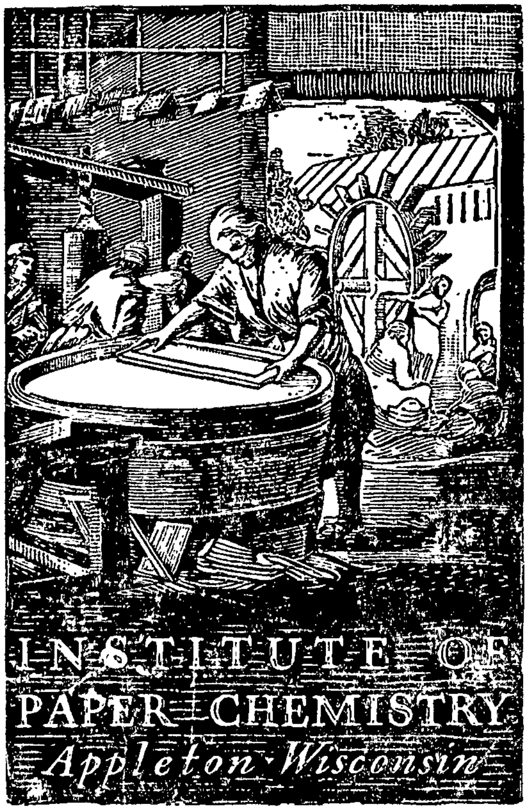


# BIBLIOGRAPHY ON THE EVALUATION AND PROPERTIES OF PAPER BAGS AND SACKS

Project 2033

Progress Report One

to

MULTIWALL SHIPPING SACK PAPER MANUFACTURERS

July, 1958

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

Bibliography

on

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# PREFACE

This bibliography covers the literature through May, 1958 on the evaluation and properties of paper bags and sacks. In addition, testing methods for films are included. Where no abstract is given, neither the original nor an abstract was available. The chief sources of reference were Bulletin of The Institute of Paper Chemistry, Chemical Abstracts and Packaging Abstracts. This is Progress Report One of Project 2033. Progress Report Two will cover the manufacture and uses of paper bags and sacks.

1. Adhesives for printed matter. Patra J. 3, no. 4:157-8(Jan., 1940); B.I.P.C. 10:320.

The efficiency of an adhesive depends to some extent on whether or not it will wet the surfaces which are to be joined together, particularly if they are nonporous. It is often a difficult matter to wet the hard dry surface of printing ink. The present investigation concerned the pasting of paper bags which were printed on the outside with an almost solid design in blue ink. No special glue flaps had been left unprinted and no difficulty was experienced if the bags were made up soon after printing. On the present occasion a quantity had been stored for some time before pasting and it was found impossible to obtain satisfactory adhesion with the usual paste. Experiments were made with 13 different adhesives, some with the addition of a wetting agent. Two gave satisfactory results but involved an odor problem; glue with ammonium ricinoleate was the only satisfactory adhesive, particularly when dried in the oven.

2. Allen, R. J. L., and Paine, F. A. Transport trials and laboratory tests on food containers. I. Lined kraft-paper bags. J. Sci. Food Agriculture 2, no. 5:208-17(May, 1951); B.I.P.C. 21:867; Packaging Abstr. 8:533.

The serviceability of kraft-paper bags lined with greaseproof paper for packaging corn flour has been assessed in statistically designed transport trials. Closely similar results were obtained by laboratory drop tests. However, conventional strength tests on the kraft paper showed no correlation with the behavior of the bags in service.

3. Allen, R. J. L., and Paine, F. A. Transport trials of paper bags. Modern Packaging 26, no. 1:156-9, 199(Sept., 1952); B.I.P.C. 23:118.

This is a reprint of Abstr. No. 2, with the exception of the appendix containing eight tables.

4. American Cyanamid Co. The past, present and future of wet-strength papers. Paper, Film and Foil Converter 28, no. 7:19-22(July, 1954); B.I.P.C. 24:1016.

Wet-strength paper is expected to play a big role in the expansion of the paper market, calculated at 1000 pounds of paper/person in the United States in 1980. Properties of wet-strength papers (Melostrength papers of the company) are compared with ordinary papers in tensile, fold, and printing qualities. Application in special products such as ice-cube bags, potato bags, filter papers, etc., are discussed; a big future is looked for in disposable and nondisposable wearing apparel.

5. American Maize-Products Co. Bag flattener simplifies palletized handling of multiwall bags. Packaging Parade 21, no. 243:170-2, 174(April, 1953); B.I.P.C. 23:668.

Palletized handling of multiwall bags is difficult because of the

shifting nature of the material contained in these bags. The company discovered a means to accomplish such palletizing successfully by passing the filled and stitched bags through a bag flattener. The system used for this operation and the route of the bag from the time it is filled until it is unloaded from a railroad car are described.

6. The American market for large-capacity shipping bags. Rev. papiers et cartons 15, no. 20:9-10(Oct. 15, 1952); B.I.P.C. 23:356; Packaging Abstr. 10:356.

The different constructions of American single-ply or multiwall shipping bags, types of closures and papers employed, the usual physical characteristics of kraft bag paper, and the use of wet-strength paper are described.

7. American Society for Testing Materials. Standard method of drop test for bags. ASTM Designation: D 959-50. 1955 Supplement to Book of ASTM Standards, part 7:1094-96.

8. American Society for Testing Materials. Tentative methods of test for tensile properties of thin plastic sheets and films. ASTM Designation:D882-56T. 1957 Supplement to Book of ASTM Standards, part 7:42-9.

9. American Viscose Corp. New cellophane flex tester. Gravure 2, no. 10:52(Oct., 1956); Packaging Abstr. 13:1017; Printing Abstr. 11:785.

This unit was designed to reproduce to some degree the old hand flex operation used to determine the durability of cellulose film. The effect of printing and other drying operations on durability of the film can be readily evaluated with the flex tester by checking samples taken before and after processing. The operation of the device is described.

10. Anderson, A. A., and Morfitt, G. L. Mechanical properties of thin polyethylene film. Modern Plastics 35, no. 8:139, 142, 144, 147-8, 222, 224, 226(April, 1958); B.I.P.C. 28:1281.

An apparatus for determining the stress-strain characteristics of thin plastic films at elongation rates of 0.03-6.0 in./sec. and at temperatures down to -70°C. is described. The effects of temperature and elongation rate on the properties of high-molecular, high-pressure polyethylene film and its heat seals are discussed. In general, ultimate strength and yield stress increase with decreasing temperature, whereas ductility and rupture energy are reduced by lowering the temperature or by increasing the rate of extension. An increase in elongation rate also raises the ductile-brittle transformation temperature of the film. A transition in the flow behavior of polyethylene film between -15 and -45° and its effect on the mechanical properties are described.

11. Anderson, R. P. Gurley-Hill S-P-S smoothness test evaluation of sack paper for nonskid properties. Tappi 41, no. 5:150-1A(May, 1958).

The three common procedures for carrying out the evaluation of smoothness with the Gurley-Hill S-P-S tester No. 4190 are outlined, and the advantages and disadvantages of using this type of test for evaluating the non-skid properties of multiwall sack paper are pointed out.

12. Anderson, R. P. The Frag tester sack paper tester no. 831. Tappi 41, no. 5:154-5A(May, 1958).

The Frag tester measures the resistance of paper to repeated impacts by a force smaller than the breaking load of the paper. The instrument consists of a metal cylinder over the open bottom of which is clamped the test specimen. The sample is clamped directionally so that the two major directions of paper may be tested separately. There is a considerable degree of correlation between the Frag test and the tensile times stretch and Van der Korput dynamic tensile test. The test may be of practical value to compare absolute bursting strength of bag constructions now in use to establish standards for different constructions that will provide satisfactory performance.

13. Anderson, R. P. The Instron tester. Tappi 41, no. 5:158-9A(May, 1958).

The Instron tester is a versatile and accurate tester that can be applied to the evaluation of many properties of paper and other materials. Application of the instrument in tensile, stretch, work or rupture energy, fatigue, and modulus of elasticity tests are described. The nature of the tester and its cost would seem to predicate its use primarily for work of an investigational and/or research nature, rather than routine quality control.

14. Andersson, Olle. Intermittent stresses placed on paper. Allgem. Papier-Rundschau 1956:271-2, 274-5; C.A. 50:17443.

The Swedish impact strength tester ("Impulsprüfer") was used in determining the relationship between the strength properties of a paper and those of the bags made from this same stock.

15. Andersson, Olle. Paper as a visco-elastic body. VI. An impulse method for measuring the impact strength of paper. Svensk Papperstidn. 56, no. 11:403-11(June 15, 1953); B.I.P.C. 23:898.

The response of paper to shock loading has been investigated theoretically, and possible methods for determining the stress-strain characteristics, including the rupture energy, are discussed. A new concept is presented, involving the measurement of the momentum or impulse transmitted through a test sample. An instrument for measuring this quantity is described, and the variations of the impulse under different testing conditions are discussed. The influence of mechanical pretreatments of the sample was studied. A comparison of the impulse measurements and practical strength figures obtained from drop tests carried out with paper sacks indicates that impulse tests have a higher correlation with service strength than the results of the classical tests.

16. Andersson, Olle. Pulp quality and paper quality. Svensk Papperstidn. 54, no. 15:505-9(Aug. 15, 1951); B.I.P.C. 22:138; Packaging Abstr. 8:719.

Over a production period of 300 days, routine tests on strength data of bag paper of constant basis weight and of the corresponding pulps from which the papers had been manufactured were evaluated statistically. Relationships based on correlation coefficients were derived from strength data obtained with machine-made paper and laboratory handsheets; this relationship is rather poor. The agreement between the properties of laboratory handsheets beaten in the laboratory beater and a mill-size jordan is considerably better. This indicates that a considerable difference exists between the properties of the sheets made on the paper machine and the laboratory sheet machine. Relationships between the different strength properties of the identical material were calculated. The relationships between bursting strength and other properties are relatively poor, whereas just the opposite holds for tear. In the case under investigation a positive correlation was found to exist between tensile strength and tear of machine-made paper, whereas a negative correlation was found between the same properties of the corresponding pulp. A possible explanation is based on a discussion of the nature of the tear test. The bursting test is discussed in detail and formulas for the stress distribution in the paper in the bursting-strength tester are given.

17. Andersson, Olle, and Bergström, J. Testing paper. Teknisk Ukeblad 104:315-20(April 18, 1957); Battelle Tech. Rev. Abstr. 6, no. 8:570a (Aug., 1957); Packaging Abstr. 14:916.

A description of tests used in determining paper strength under various strains such as pull, tearing, folding, and shock load, and in measuring paper rigidity, softness, dimensional stability, surface, smoothness and permeability.

18. Apparatus for testing plastics. Neue Verpackung 8, no. 3:103-5 (March, 1955); Packaging Abstr. 12:347.

Illustrations and brief descriptions are given of equipment for testing hardness, tensile and tear strength, permeability, low temperature resistance, and bending strength. Some of this equipment can be used for other materials such as paper, board, etc.

19. Apple, W. W. IPC friction meter. Tappi 41, no. 5:151-2A(May, 1958).

The usefulness of the IPC friction meter, particularly in regard to the multiwall paper manufacturer or converter, is discussed. The kinetic friction measurement is significant in the development of antislip multiwall bags since it has been determined that high kinetic friction may be primarily responsible for good performance in handling and stacking of filled units.

20. Arend, A. G. Lead foil products for packing purposes. Brit. Packer 12, no. 1:36(Jan., 1950); B.I.P.C. 20:508.

Although heavy lead foil continues to be used for packaging perishable materials, it is being replaced in many instances by bags made of foil-coated kraft paper. These are waterproof, airtight, lighter in weight, and considerably less expensive. Lead-clad plywood and lead-coated iron and steel sheets are some of the recently developed box and case materials utilizing lead foil. Recent improvements in the production of ordinary lead foil are mentioned.

21. Arend, A. G. Modern wet-strength multi-walled paper bags. Brit. Packer 10, no. 6:31(June, 1948); B.I.P.C. 18:787.

Melamine or urea-formaldehyde resins, added to pulp while it is still suspended in water, adhere to the fibers, which are later bound tightly together to produce a tough strong paper with high wet-strength and increased folding endurance. Multiwall bags, made of as many as six plies of the paper laminated with asphalt, have revolutionized numerous retail packaging methods, and the paper itself has found many new uses. Each product to be shipped in such containers must be carefully studied to determine the qualities necessary in the bag. Sifting, contamination of the product from bacteria and insects, protection from absorption or loss of moisture, and the possibility of abrasion by the product have been subjects for research in this field.

22. Arkell and Smiths. Multiwall bags with 'tilted' valves. Modern Packaging 29, no. 10:203(June, 1956); Packaging Abstr. 13:659.

The valve alters the flow of material during filling, forcing the valve upwards and closing it, to eliminate sifting both during and after the filling process. The 'tilted' valve is also said to facilitate fitting the bags onto filling spouts.

23. Army engineers test multiwall paper bags for packaging asphalt. Chem. Eng. News 30, no. 36:3770(Sept., 1952); Packaging Abstr. 9:862.

Hot liquid asphalt is poured into the bag which has a content of 100 lbs. A clay coating on the inner bag liner prevents it from sticking and facilitates stripping of the bag from the contents.

24. Arnold, John W. Effectiveness of *p*-dichlorobenzene in plastic garment bags. Soap and Chem. Specialties 32, no. 2:121-4, 167, 169(1956); C.A. 50:5969.

Permeability studies on vinyl and polyethylene films used in making garment bags showed that the films retained up to about 60% of *p*-dichlorobenzene vapors, based on vapor loss from uncovered controls. Permeability of a film was significantly decreased by doubling its thickness, embossing with a fine pattern, or adding pigment. Tests with a similar series obtained by cutting sections from garment bags produced by different companies showed no constant correlation between permeability and gage or type of film. Some structural features contribute to loss of vapors, but this loss is insignificant compared with that through the whole bag. Dosage-mortality studies in air-tight chambers showed that vapor saturation (equilibrium) was reached with vaporizations of 3.5 g. p-dichlorobenzene; equilibrium occurred with 100 g. in 6 days and 300 g. in 2 days (100% larvae mortality). Equilibrium did not develop in garment bags in 7 days, although up to 97 g. p-dichlorobenzene vaporized; larvae mortality was 80% or lower. No appreciable vapor concentration developed in an open room with up to 300 g. p-dichlorobenzene. It is concluded that under certain dosage and exposure conditions, most plastic garment bags may serve as fumigation chambers for control of insect garment pests with p-dichlorobenzene, but the effectiveness of different bags varies greatly and it is difficult to prescribe a single procedure for effective use that is adequate for the poorer bags and not excessive for the better ones. Based on these results, suggestions for the use of plastic bags are given.

25. Arnold, Kenneth A. Insect repellent coatings for multiwall paper bags. Tappi 38, no. 6:326-8(June, 1955); B.I.P.C. 25:873; Packaging Abstr. 12:706.

Progress in the development of a multiwall paper bag completely impervious to penetration by flour-infesting insects, especially for shipment of flour into hot humid areas favorable to breeding of insects, is reported. Pyrenone, a combination of 10 parts piperonyl butoxide and one part pyrethrin, was proved to be effective and commercially feasible; tests showed that multiwall bags with the outer ply and sleeve coated with Pyrenone were completely resistant to all insects employed in the tests. Permission was granted by the U. S. Pure Food and Drug Commission for use on the outer surface of multiwall flour bags. Field tests, coating methods, stability of Pyrenone coatings, analytical methods, and tests with other insecticides are also covered.

26. Arnold, Kenneth A. Physical properties of paper coated with polyethylene by extrusion. Tappi 39, no. 5:324-9(May, 1956); Modern Packaging 29, no. 8:138-42, 144, 212(April, 1956); Packaging Abstr. 13:551; B.I.P.C. 26:838; C.A. 50:10407; Printing Abstr. 11:469; J. Appl. Chem. (London) 6, no. 11:ii-411(Nov., 1956).

In a flexible package, such as a multiwall bag, the shock resistance of the paper is of primary importance. Experience in packaging chemicals in bags containing a polyethylene-coated ply indicated that the contribution of this ply to the shock resistance of the completed bag was considerably greater than indicated by any of the standard paper tests. In some respects, this experience is parallel to that with bags having all plies creped. A complete study has been made comparing results of paper tests on uncoated and on polyethylene-coated kraft papers. The effect of varying the coating weight on these properties has also been determined. Increase of coated vs. uncoated paper in test results of bursting strength, tensile, and stretch are not appreciable. Increases in tear resistance and dynamic tensile strength through polyethylene coating are significant. Other types of shock or impact testers have also demonstrated that an appreciable contribution results from polyethylene coating.

27. Aronovosky, S. I., Ernst, A. J., Seidl, R. J., and Kingsbury, R. M. Straw pulp-wood pulp blends for various types of papers. Tappi 35, no. 8:351-6(Aug., 1952); B.I.P.C. 23:50.

Illinois combined wheat straw was pulped by the mechanochemical process, bleached, and blended with Lake States wood pulp to produce typical magazine, book, newsprint, bond, bag, waxing, and greaseproof papers on an experimental Fourdrinier paper machine. Control runs were made using wood pulps only. The inclusion of straw pulp in these paper furnishes resulted in improved formation, bursting and tensile strengths, and folding endurance. The tearing resistance of the straw-containing papers was somewhat lower than that of the controls, but the reduction in tear was relatively small. It is evident from these preliminary data that straw pulp could be used to good advantage in improving many types of specialty papers.

28. Bag paper and hygiene. Allgem. Papier-Rundschau no. 8:328-30 (April 20, 1953); Das Papier 7, no. 11/12:209-10(June, 1953); Wochbl. Papierfabr. 81, no. 9:307-8(May 15, 1953); B.I.P.C. 23:868.

The use of paper grades containing regenerated stock for the packaging of foodstuffs is sometimes considered objectionable from a hygienic viewpoint. A German association for the promotion of waste-paper collection in Düsseldorf sought the expert opinion of two medical scientific institutions in this matter. In the manual folding and pasting of paper bags it may be assumed that part of the micro-organisms present on the hands of the workers will adhere to the paper after conversion. Paper samples prepared from virgin pulps and regenerated stock were supplied to both institutions, which investigated independently their tendency for absorbing and holding bacteria. Details of the methods employed in both cases are described. One institution found that smooth and absorbent papers are more liable to pick up bacteria. However, both testified that paper, irrespective of furnish, is an unsuitable medium for promoting bacterial growth; under certain conditions it even inhibits the same. The paper-manufacturing process, i.e., drying at elevated temperatures, is sufficient to destroy all pathogenic germs. One institute, a dermatological clinic, applied samples directly to the skin of infected patients. In isolated cases, the growth of yeasts could be determined after a few days on both types of samples; there was no difference between the papers made from virgin pulp or waste paper.

29. Bags and adhesives. Packaging Parade 14, no. 159:68(April, 1946); Packaging Abstr. 3:447.

New types of adhesives which retain their "grip" even after immersion from four to forty-eight hours in water are an important war-time development. The adhesives used by the Union Bag and Paper Corporation to seal their bags are briefly described.

30. Bags for heavy solids and liquids. Paper Container 50, no. 1:13 (1944); Packaging Abstr. 1:28.

Kraft multiwall heavy duty bags are used in America for sand. The bags passed a 300 hours' test in a weatherometer. An inner asphalt laminated sheet was used to protect the bag from the moist sand. The outer three walls are of kraft and the outside coated with a weatherproof material. Casein glue was used and a mildewproof cord for closing the bag. A paper bag from two sheets of 50-lb. kraft laminated with a waterproof glue has a sewn bottom which is dipped in wax. The bag is strengthened by placing in a corrugated fiberboard case. The actual construction varies with the liquid being packed (e.g., emulsions, oils, asphalt, inks and paints).

31. Bakelite Co. Bag drop tests for plastic films and bags. Packaging with Plastics 1, no. 2:3(Aug., 1955); Metal Box Co. Ltd., Research Division of the Survey of Literature, Jan., 1956:18; Packaging Abstr. 13:667.

In this test, developed by the Bakelite Co., bags are made from the film being tested, filled with sand and closed with pieces of wire. The bags are then dropped from heights, increased by 1 ft. at a time, until they fail, as indicated by noticeable leakage of sand.

32. Bakelite Co. Lab finds 'gremlins' in poly film cracks. Packaging Parade 24, no. 6:128(June, 1956); Packaging Abstr. 13:734.

Tests undertaken by the Bakelite Co. have shown stress cracking takes place when polyethylene film contacts certain liquids and is then folded or otherwise put under stress. Silicone release agents often used on commercial band sealers cause stress cracking when exposed film packages are cramped in a carton. In order to prevent sticking difficulties the bands may be coated with tetrafluoroethylene, or a glass fabric belt impregnated with a silicone elastomer might be used as the separating agent. The bare metal bands may be used successfully without lubrication if they are kept very clean, the sealing temperature is accurately controlled, and adequate cooling provided for the belt.

33. Barrier for K-rations. Am. Paper Converter 19, no. 3:14(March, 1945); Am. Paper Merchant 42, no. 4:32(April, 1945); Fibre Containers 30, no. 2:94(Feb., 1945); Packaging Parade 13, no. 146:59(March, 1945); B.I.P.C. 15:343.

To provide an additional moisture barrier for K-rations used in the Pacific area, a substantial portion of the containers will incorporate a triplex, asphalt-impregnated bag between the outer case and the packaged ration. The material used is creped in two directions and flexible. The closure is also waterproof, the ends of the bag on the inside being coated with an adhesive that seals under pressure.

34. Basic types of multi-wall sacks. Paper Container 70, no. 1:8-9 (Jan., 1954); B.I.P.C. 24:478.

Multiwall paper bags lined or coated with polyethylene are recommended for the shipment of a number of smaller packages with hygroscopic pulverulent contents (egg powder, flour, sugar, salt, etc.). The five principal types of multiwall bags and their closures are described; special precautions for waterproofing the seams are listed. Tests made with these sacks as carriers and protectors have proved their suitability for such contents.

35. Belyaĭ, D. I. Conditions for keeping mineral fertilizers in paper sacks. J. Chem. Ind. (U.S.S.R.) 14:1065-7(1937); C.A. 32:709.

Sunlight, high temperature and moist air weaken paper sacks.

36. Belyaĭ, D. I. Impregnating bag paper with cuprammonium solution of naphthenic acids. Bumazh. Prom. 15, no. 7:45-8(1937); C.A. 32:2350.

Preliminary laboratory and factory tests are described for the reinforcement of sized paper (18-25° freeness) and kraft paper, used in making bags, with a cuprammonium solution of naphthenic acids (acids 203.4, copper oxide 58.3, $Fe_2O_3$ 5.4, and ammonium hydroxide 52.7 g./l.). A paper sheet was immersed in the solution for 15 sec. to 5 min., the excess solution was allowed to drain and the sheets were dried in a drying oven at 80-100°C. for 3-5 min. and then tested. The treated paper showed no permeation by water after 72 hrs. of exposure as compared with 3-4 hrs. for papers impregnated with bituminous and paraffin products. In the permeability to air and in mechanical properties the treated paper was inferior to the untreated paper.

37. Belyaĭ, D. I. The use of kraft paper bags for transporting and storing potassium fertilizers. Kalii (U.S.S.R.) no. 5-6:27-33(1937); C.A. 32:1847.

The paper was impregnated with 40% of bitumen and five layers of this paper were used to make bags. The potassium chloride did not react with the paper. Impregnation of the paper with a mixture of 203.4 g. of naphthenic acid, 58.3 g. of copper oxide and 52.7 g. of ammonia improved its water resistance as compared with bitumen paper, but its mechanical resistance was just half that of bitumen paper.

38. Bemis Bro. Bag Co. How to get best performance from Bemis paper bags. St. Louis, Mo., The Co. 8 p.; Packaging Abstr. 7:35.

The moisture content of paper bags should be maintained at 6 to 7% if the maximum strength is to be developed. A check should be kept on the humidity during storage, and if necessary an air humidifier should be used.

39. Bemis Bro. Bag Co. Important facts for the man in charge of paper bag storage. St. Louis, Mo., The Co.; Packaging Abstr. 3:465.

Hints are given on the storage and conditioning of paper bags.

40. Bemis Bro. Bag Co. Packaging picture. St. Louis, Mo., The Co. 14 p.; Packaging Abstr. 3:652.

The story of the manufacture of Bemis multiwall paper shipping sacks is recounted from the pulp stage, through the drying, folding, cutting and closing phases until the finished product is ready for action. The designing and testing of the bags are also described. Illustrations are included.

41. Bemis Bro. Bag Co. Reinforced end multiwall bags. Ind. Packaging 2, no. 7:48(July, 1956); Packaging Abstr. 13:747.

The reinforcement consists of strips of kraft paper between plies at the bag's top and bottom, giving the effect of an extra ply at the points where most sewn multiwall bag breakage occurs.

42. Bemis Bro. Bag Co. Things few users know about bags. Packaging Parade 14, no. 158:38-9(March, 1946); Chem. Industries 58, no. 5:828, 830 (May, 1946); B.I.P.C. 16:463.

Directions are given in text and illustrations for the correct storage of paper bags, with particular reference to maintaining proper humidity conditions. Bags which are allowed to dry out are liable to break in packing; when the normal moisture content is restored to the bags, the breakage difficulties will be eliminated.

43. Berger, L., Weber, I., and Gallaccio, A. Tensile strength testing of spray formed and cast vinyl films. II. Effect of some variables. Rubber Age (N.Y.) 77:551-8, 564(1955); Rubber Abstr. 33, no. 10:439(Oct., 1955); Packaging Abstr. 13:7.

From test results, which are reported in full, it is concluded that tensile strength values of spray-formed vinyl films are affected significantly by variations in formulation, conditions of film preparation, and aging. The tensile strength of cast vinyl films decreases with increasing specimen thickness. The practice of assuming that the width of a tensile specimen is equal to the width of the die used may lead to erroneous results. In order to obtain reproducible results within a laboratory, it is necessary to sample from three films, each prepared on a different day and by a different operator.

44. Bergström, J. Precision and reproducibility in testing the breaking load and elongation at break of kraft paper. Svensk Papperstidn. 59, no. 8:305-9(April 30, 1956); B.I.P.C. 27:840; Packaging Abstr. 13:469.

The precision of a test method is measured by the smallest statistically significant difference between the averages of two test series made under identical conditions on the same paper, whereas the reproducibility of a test is measured by the corresponding difference between measurements made at different laboratories. Four kraft paper samples were tested on ten pendulum-type tensile testers representing four different makes or models. In measuring elongation at break (stretch), systematic deviations of the order of 0.5% were found between different instrument models. However, even absolute differences of 1% between test results from two laboratories need not necessarily imply that the true stretch values of the two papers are different. In measuring breaking load, the corresponding difference was found to be 0.7 kg. at 10 kg. breaking load, or 7% relative. For checking the stretch scale it is recommended that the tensile tester be run with a test sample which does not stretch at the loads applied.

45. Bergström, Jan. Service strength of paper bags under dynamic conditions. A statistical approach. Svensk Papperstidn. 61, no. 5:119-27 (March 15, 1958); B.I.P.C. 28:1241.

The rupture of a paper bag or sack subjected to rough handling (as simulated by drop tests) may be considered a matter of probability. The probability of rupture is determined by the paper strength (primarily the impact strength) and the magnitude of the stresses induced in the paper. As the impact strength decreases at each drop, the rupture probability increases. Good agreement was obtained between measured and calculated drop-number distributions.

46. Bhargava, R., Rogers, C. E., Stannett, V., and Szwarc, M. Studies in the gas and vapor permeability of plastic films and coated papers. IV. Effect of a paper substrate. Tappi 40, no. 7:564-7(July, 1957); B.I.P.C. 28:76; Packaging Abstr. 14:1011.

The permeation rates of gases (nitrogen, oxygen, carbon dioxide, and hydrogen sulfide) and water vapor at different temperatures and pressures through polyethylene-coated or -laminated glassine and kraft papers and bleached board were determined, using coatings of different thicknesses. The paper substrate was shown to have no effect on the permeability constant, except where it leads to capillary defects. The effect of temperature is governed by polyethylene at lower temperatures and by glassine at higher temperatures. A special case of low permeability of polyethylene-coated paper is described and tentatively explained.

47. Bischoff, Ernst. Investigations on the technique of the drop test. Verpackungs Rundschau 7, no. 11:Suppl. 85-91(Nov., 1956); B.I.P.C. 27:560; Packaging Abstr. 14:120.

The technical bases of the drop-test method as a criterion for the resistance of packaged units against transport impacts are discussed. Factors affecting the results obtained in this test, such as angle of impact, drop height, and type of packaged commodity, are examined statistically. Several drop tests no longer in use are described, and directions for conducting impact-resistance tests by the free-fall method are given.

48. Blair, C. L. Make your own film identity tests. Paper, Film and Foil Converter 31, no. 4:26-7(April, 1957); B.I.P.C. 28:76.

Practical tests by which the average consumer can identify the type of plastic film used in a package are described. Reactions of the various films in tear, halogen, burning, and solubility tests are listed.

49. Blocking tester. Kunststoffe 45, no. 3:109(March, 1955); B.I.P.C. 25:742; Packaging Abstr. 12:701.

The blocking tester for plastic films, artificial leather, and similar materials developed by Chemische Werke Hüls is now commercially available from Karl Frank GmbH. at Weinheim-Birkenau, Germany. Two different clamping rings for thin and thick specimens are provided for the simultaneous testing of six samples.

50. Boer, J. H. de, and Fast, J. D. Diffusion of hydrogen through regenerated cellulose and some cellulose derivatives. Rec. trav. chim. 57: 317-32(1938); C.A. 32:4778.

A new diffusion apparatus is described. Hydrogen diffuses through metals in the atmospheric form, and through cellulose acetate in the molecular form. With molecular diffusion the rate is proportional to the pressure difference. Diffusion through cellulose derivatives (celluloid, cellulose triacetate, cellophane) is greater than through cellulose, probably because of the greater distances between the long-chain molecules in the derivatives. While hydrogen diffuses readily through nitrocellulose and cellulose acetate, these derivatives are practically impermeable to air.

51. Boggs, Jesse K., and Sullivan, George H. Greaseproof paper. U. S. patent 2,416,734(March 4, 1947); B.I.P.C. 17:459.

The corrosive action of greaseproof paper towards steel or other corrodible material is inhibited by the use of phosphates of certain amines. Among suitable compounds are primary alkyl amines with from two to seven carbon atoms, primary alkanol amines with from one to eight carbon atoms, secondary amines in which the substituents may be alkyl or alkanol groups with from one to six carbon atoms, tertiary amines in which the substituents may be alkyl groups with one or two carbon atoms or alkanol groups with from one to three carbon atoms, water-soluble quaternary amines, morpholine, ethylenediamine and polyamines, and benzylamine. Thus, a 25-pound greaseproof paper is impregnated with 1.9 pounds of a 5.3% aqueous solution of diamylamine phosphate, giving a product with no corrosive action on steel plates. A laminate of a 40-pound greaseproof paper and a 30-pound kraft paper (with microcrystalline wax) may have its greaseproof side impregnated with a solution containing 50% of glycerin, 0.5% diamylamine phosphate, and 49.5% water. The inhibitor may be used also in a laminating solution. An example is a solution containing 44% of starch, 44% of glycerin, and 12% of diamylamine phosphate. The use of the amine phosphate gives a paper the pH of which remains stable over wide variations of climatic conditions and upon aging. A noncorrosive tape may be made by slitting the impregnated paper and it may be made up into cartons or bags.

52. Boor, L., and Dixon, J. K. Application of a thermal conductivity method to the determination of moisture vapor transmission of packaging materials. Paper Trade J. 119, no. 18:26-34[T.S. 176-84](Nov. 2, 1944); B.I.P.C. 15:136; Tech. Assoc. Papers 27:689-97(June, 1944); Paper Maker 109, no. 1:TS1-8(Jan., 1945); Paper Box and Bag Maker 99, no. 2:35, 37-8, 40; no. 3:65-6, 68, 70-2(Feb., March, 1945); C.A. 39:190.

The application of the Permeameter, which was developed to measure permeability of balloon fabrics to hydrogen, to the measurement of water-vapor transmission is described. Certain modifications were required to make this adaptation, all of which are given in detail and their effects are noted. A systematic comparison was made of the various methods used for measuring water-vapor permeability; the methods included are the Payne cup method, pie plate method (similar to the General Foods moisture vapor transmission test), the TAPPI standard method, and The Institute of Paper Chemistry method. The data given indicate that the Permeameter can be used to measure the permeability of the different materials and possesses certain advantages over the other procedures. Also to be noted is the fact that the time required for testing is of such short duration that the instrument can be readily adapted for control purposes.

53. Brabender, G. J. Determining water vapor permeability of sheet materials; progress report. Paper Trade J. 108, no. 4:39-43(Jan. 26, 1939); B.I.P.C. 9:255; Tech. Assoc. Papers 22:251-5; discussion, 96-9(June, 1939); C.A. 33:4027; B.C.P.A. 1939B:472; Tech. Bull. 16:63.

"Water vapor permeability tests have been made on seven different sheet materials by eleven co-operating laboratories using the suggested standard procedure for this test. The results have been assembled, tabulated, and analyzed. The analyses indicate that: (1) The temperature and humidity conditions prevailing within the testing chamber must be controlled within very narrow limits in order to obtain reasonable check results. (2) The amount of desiccant within the test cell must be considerably greater than that proposed when very permeable sheet materials are being tested in order to avoid saturation of the desiccant. Bringing fresh desiccant in contact with the low humidity face of the sheet at intervals during the test will also eliminate the factor of saturation. (3) Large percentage, but low absolute deviations may be expected in water vapor permeability values on low permeability materials due to ordinary variations in the material itself. Highly permeable materials may be expected to show a percentage of deviation of 10% between different laboratories. Many of the objections to previous methods for testing water vapor permeability have been eliminated by the proposed method, expecially those concerned with the method of sealing, edge leakage, test area, condensation, total pressure and vapor pressure difference across the sheets, and the convection and diffusion rate of water vapor across an air space of various dimensions. The influence of the humidity range at constant vapor pressure difference across the faces of the sheet and the influence of testing temperature remain as factors which are not fully evaluated by the proposed method. Data are presented to show that the first of these factors is of sufficient importance to receive recognition in a proposed testing mathod. There is some evidence to show that the temperature factor may be of equal importance, but additional data are required to determine its exact influence on the permeability of various sheet materials."

54. Braithwaite, W. E. Simplification and standardization of containers and packages. Ind. Standardization 7, no. 10:265-9(Oct., 1936); B.I.P.C. 7:89.

Reference is made to the activities of the Division of Simplified Practice of the National Bureau of Standards, with special emphasis on shipping containers of all kinds. Illustrations of setup boxes and paper bags indicate the unnecessary diversity of containers existing and the urgent need for standardization.

55. Brickman, C. L. Measuring gas transmission of flexible materials in pouch form. Package Eng. 2, no. 1:21-5, 54(Jan., 1957); Packaging Abstr. 14:298.

The method described nearly simulates actual use conditions. A shell molded from styrene is inserted in the pouch, to ensure a nearly uniform volume, air is exhausted, then replaced with nitrogen at a specified gage pressure. If a wet atmosphere inside the pouch is desired, a definite amount of water is also introduced. From 8 to 10 units are made up for each exposure condition. Duplicate samples are examined immediately for per cent initial oxygen content, and thereafter at stated intervals. The rate of oxygen permeability is calculated from the free gas-space volume of the pouch, area, time and change in partial oxygen pressure. The method can be applied to wet or dry products exposed to different room and refrigeration conditions.

56. British Standard Institution. British Standard Packaging Code. Brit. Standard 1133, 1944. Reviewed in Packaging 26, no. 164:39(1944); Paper Box Bag Maker 97, no. 2:25(1944); Packaging Abstr. 1:46.

This book has been prepared on the instructions of the Anglo-American Committee of the Ministry of Production. The Committee included representatives of Government Departments, research and trades interests (including a representative of the Printing and Allied Trades Research Association) and the railway companies. The following aspects of packaging and handling and use of packages for Government purposes, both for domestic and overseas shipment, are considered; the factors to be considered in designing packages to withstand handling, transportation and storage, particularly for specially difficult contents, limitations enjoined by marine, rail or air transport, standards for wrapping papers and films of all kinds and bags made from these, multiwall bags, and fiberboard containers, etc., wooden, metal and glass containers, cushioning materials, cordage, closing and sealing tapes, tensional steel strapping. The final section gives standard testing methods for paper, board, cellulose film, wood, tensional steel strapping, felt and sealing tapes.

57. British Standards Institution. Paper and board wrappers, bags and containers. Brit. Standard 1133. Revised, 1952. 171 p.

Specifications are given for all types of paper and film bags, and multiwall paper sacks.

58. British Standards Institution. Sizes of single-ply paper bags. Brit. Standard 1891. 1952. 10 p.; Packaging Abstr. 9:846.

The specification covers kite, cone or cup bags, flat or satchel bags, self-opening satchel bags, rose bottom bags and half patent bags. The method of measurement is illustrated.

59. Brook, A. T. Developing the paper sack. Chem. Age 63, no. 1631: 536-8(1950); Rev. Current Lit. Paint, Colour, Varnish and Allied Ind. 23, no. 138:649(Nov.-Dec., 1950); Packaging Abstr. 8:281.

An account of recent research to develop paper sacks more shock-resistant than those in current use is given. The use of polythene-treated paper is favorably commented upon.

60. Brook, A. T. Fertilizer packaging. The development of the paper sack. Fertiliser Soc. (Engl.) Proc. no. 11:46 p.(1950); C.A. 45:4864.

Improved methods of testing the strength and moisture-resisting properties of paper sacks, the testing and development of new methods of sewing and new types of thread to eliminate stitch rot of sacks, and the effect of temperature and decomposition of fertilizer materials on the durability of the fertilizer package are described.

61. Brooks, R. F. Thomas, Robert E., and Hucker, G. J. Food packaging studies 1. Durability of certain non-metal materials for bulk packaging. Modern Packaging 19, no. 10:152-4(June, 1946); B.I.P.C. 17:149.

The object of the present study was to determine the relative durability of various types of nonmetal packages which might be used for bulk packaging of fruits and vegetables, with particular reference to frozen and dehydrated foods. The package consisted of a carton-bag-carton unit; the bag materials used included: triple laminated cellophane, laminated foil, wax-coated rigid cardboard containers, and heavy duty, x-creped sheets. Two carton units were packed in a wooden case, stored and conditioned for 72 hours at various low and high temperatures, and then subjected to a number of drop tests; finally, they were immersed under a six-inch head of water for 72 hours. The package should remain waterproof after this series of tests. The procedures and results are described in detail. None of the nonmetal containers studied was found to be as effective as metal in the packaging of vegetables; the asphalt-impregnated x-creped kraft sheet with latex closures showed the most promise. An additional lamination of lead foil materially enhanced the efficiency from the standpoint of water-vapor transmission, but impaired the durability on rough handling.

62. Brown, W. E. There's no ideal packaging material, but--. Paper, Film and Foil Converter 31, no. 1:19-23(Jan., 1957); B.I.P.C. 27:551.

A chemically acceptable packaging material (e.g., plastic film) should have these qualities: inertness, safeness, selective permeability, useful temperature range wider than that of the material being packaged, corrosion resistance, resistance to light and weather, capability of being processed by modern packaging machinery, and long package life. Both inertness and safeness of plastic packaging films are largely dependent upon the additives used. Accelerated methods of testing these and other product characteristics may produce results not warranted by actual usage. Permeability to water, moisture vapor, and gases may be decreased by lamination to other materials, by x-ray irradiation (as in the case of polyethylene), and by increasing the D.P. of the film material. Permeability may be increased by use of plasticizers and by perforating the film.

63. Brubaker, David William, and Kammermeyer, Karl. Flow of gases through plastic membranes. Ind. Eng. Chem. 45, no. 5:1148-52(May, 1953); B.I.P.C. 23:745; Packaging Abstr. 10:568.

Permeability data are reported for 54 film samples for five common gases (helium, hydrogen, carbon dioxide, nitrogen, and oxygen) at three different temperatures. The effects of pressure and temperature of the gases as well as of the thickness, molecular weight, plasticizer content, and polymeric type of the films are discussed. The permeability data reported are particularly useful in commercial applications, such as packaging; in addition, they may be used for predicting gas separation characteristics of plastic films, as the permeation of the components of gas mixtures is directly proportional to their respective permeabilities.

64. Buckley, M. S., and Whinery, J. S. A spot test for the identification of rodent urine on packaged commodities. Cereal Chem. 24:380 (1947); C.A. 51:289.

A simple spot test for urine stain on cotton, paper, or burlap bags consists of applying with a camel's-hair brush a solution of 3 g. of p-dimethylaminobenzaldehyde dissolved in 25 ml. of ethyl alcohol and made up to 100 ml. with a saturated solution of oxalic acid. A chrome yellow color will develop if urine is present.

65. Bulk packaging of chemicals; wartime trends, postwar possibilities. Chem. & Met. Eng. 50, no. 10:117-24(Oct., 1943); B.I.P.C. 14:123.

From metal to wood to paper has been, briefly, the wartime story of materials for bulk packaging of chemicals. The fundamental advantages and economies of the versatile multiwall paper bag for many solid products have accelerated a trend which may very well become highly important in postwar packaging. Other types of containers are still vitally important and will regain much of their volume use after the emergency; the shift of paper, on the other hand, is one of the basic trends in bulk packaging which has resulted from the war. The greatest part of this report is, therefore, devoted to the present and postwar possibilities of the multiwall paper bag as a tailor-made container for chemicals. Tank cars, metal drums, glass carboys, wooden barrels, textile bags, and fiber drums are reviewed briefly. The discussion on multiwall bags includes types of plies, closure, packing equipment, and chemical applications. A list of representative chemical products packed in multiwall paper bags is included.

66. Burgess, L. M. Bags and pouches for Joint Army and Navy packaging. Am. Paper Converter 25, no. 4:13, 36, 38(1951); Packaging Abstr. 8:453.

Relevant Joint Army and Navy specifications are discussed.

67. Burgstaller, Friedrich, and Krauss, Richard A. Large-scale experiments on the quality control of bag papers. Das Papier 9, no. 11/12:237-48(June, 1955); B.I.P.C. 25:897; Packaging Abstr. 12:708.

These investigations were sponsored by two German associations and carried out over a number of years. They included practical transportation tests by railroads, trucks, and boat, drum and drop tests of filled paper bags, and physicomechanical tests of paper properties. Fifteen different typical sulfate papers were evaluated; three of these were made from the same pulp beaten to distinctly different degrees (very free, medium, and very slow). Efforts were made to determine the correlations between the strain to which the paper bags are subjected in practical use and the measurable mechanical properties of the paper to find suitable test procedures for a correct quality control and evaluation of bag papers. The testing program and its results are described in detail. It was found that shipments by truck involved the least, and shipment by boat the highest number of breaks in the paper bags, with rail shipments between the two extremes; combined shipments by rail and boat produced still higher breaks than those resulting from boat shipments alone. The highest correlation between strain and paper properties was found for the static tensile-tear test determined with the Schopper or Steenberg instrument (0.97), followed closely by the dynamic tensile-impact tester (Darmstadt construction). These results will form the basis for specifications and the establishment of minimum strength properties of kraft bag papers with a basis weight of 70/75 grams/sq. m. by the German associations; the draft of the specification is appended.

68. Butterfield, D. E., Parkin, E. A., and Gale, M. M. The transfer of DDT to foodstuffs from impregnated sacking. J. Soc. Chem. Ind. 68, no. 11:310-13(Nov., 1949); B.I.P.C. 20:400; Packaging Abstr. 7:85.

A method is described for determining the amount of DDT in foodstuffs, using monoethanolamine to dehydrochlorinate the DDT, followed by electrometric titration of the free chloride with silver nitrate; the monoethanolamine does not hydrolyze the fats and oils. The method has been used to determine the quantities of DDT transferred from DDT-impregnated cotton-twill and jute-twill sacking to wheat, wheat flour, soybean flour, decorticated peanuts, and cocoa beans. The results indicated that relatively large quantities of DDT may be transferred in a few months, particularly to finely divided and fatty foodstuffs. The general conclusion may be drawn that, to prevent or control insect infestation in temperate climates, whole seeds (wheat and cocoa beans) may safely be stored for at least one year in bags impregnated with up to 1% DDT; whole unprocessed wheat may be similarly stored in bags impregnated with up to 5% DDT, whereas finely particulate or broken materials, especially if fatty (such as wheat flour, soybean flour, and decorticated peanuts), cannot be safely stored for even four months in bags impregnated with 1% DDT. In conclusion, the importance of the vapor-phase transfer of DDT is discussed briefly.

69. Cady, E. L. Purchasing. Pointers for purchasing paper bags. Purchasing 24, no. 3:104-7(1948); Mead Corp. Library Accession List 15, no. 10:1(1948); Packaging Abstr. 6:18.

The points discussed are: the importance of the properties and qualities of paper bags in the packaging, selling and use of the packaged product; test specifications; selection factors based on application conditions; and developments in paper treatment.

70. Callahan, T. Pat. Miscellaneous packages. Chem. Inds. 65, no. 4: 535-6(Oct., 1949); B.I.P.C. 20:271; Packaging Abstr. 7:288.

Miscellaneous packages, comprising chiefly multiwall paper bags, fiber drums, and fiberboard boxes, are becoming increasingly useful in the chemical industry. Plastic coatings applied to multiwall paper bags make them suitable for shipping hygroscopic materials, and fiber drums can be specially treated so that they are greaseproof, stainproof, and chemical-resistant. Paper containers are generally cheaper than other types, and their low weight decreases shipping costs.

71. Callahan, T. Pat. Multiwall bags coated with polyethylene. Chem. Inds. 65, no. 1:104, 106(July, 1949); Paper Ind. 31, no. 4:451(July, 1949); B.I.P.C. 19:872.

Brief reference is made to multiwall bags of kraft paper coated with synthetic resins (polyethylene in particular), developed by the St. Regis Paper Co. The coating gives improved protection from moisture and grease, and strengthens the paper. Polyethylene, in addition, is chemically inert, odorless, and tasteless, which makes it suitable for packaging chemicals as well as food products.

72. Callahan, T. Pat. Packaging chemicals in paper bags. Chem. Industries 59, no. 5:878, 880(Nov., 1946); B.I.P.C. 17:261; Packaging Abstr. 4:236.

The wide acceptance of heavy-duty, multiple-ply paper bags as the most efficient container for many chemicals and chemical products is principally based on two factors: (1) Paper bags and valve bag filling machines permit an efficient, mechanized, economical packaging system. (2) Valve bags provide by their construction a very high degree of protection from moisture penetration and contamination by dirt and dust; moreover, they eliminate loss of product through sifting. Heavy-duty paper bags are constructed of from three to six walls of kraft paper, each ply being arranged in tube form, one within the other, so that each carries its share of the burden. The development of a shipping sack construction highly resistant to the penetration of water vapor made it possible to use paper bags for highly hygroscopic products, such as calcium chloride. Bags for this purpose are made of five plies, two of which are of special asphalt laminated paper; both ends are frequently dipped in a special wax to give added protection. The use of a moistureproof tuck-in sleeve in the valve prevents any siftage of the product. Ease of handling and stacking is one of the advantages of paper bags; they also permit quick opening and all-around cleanliness in the plant.

73. Callahan, T. Pat. Polyethylene's star on rise as packaging lining material. Chem. Inds. 66, no. 1:102(Jan., 1950); B.I.P.C. 20:410; Packaging Abstr. 7:454.

The development of polyethylene-lined multiwall bags, as well as liners of polyethylene laminated to paper, fiberboard, and textiles, makes available a material with ideal properties for packaging a wide variety of chemical products. Polyethylene coating is odorless, nontoxic, moistureproof, and flexible at low temperature, and its ability to be heat sealed in a case, bag, or drum recommends it as a lining for hygroscopic materials. It also strengthens the sheet to which it is applied, is substantially unaffected by acids and alkalies, and provides an excellent grease and oil barrier. Multiwall bags with polyethylene liners are now available, and considerable work is being done to develop liners for other types of packages.

74. Callahan, T. Pat. Store paper bags properly. Chem. Industries 62, no. 3:442, 444(March, 1948); B.I.P.C. 18:695.

Because a drop in the moisture content of paper bags below the normal 6-7% means a loss of maximum strength, the relative humidity of a bag storage room should be high, 50% at warm temperatures being desirable. The bags should not be stored near furnaces or radiators, in excessively hot or poorly ventilated rooms, or under sun-heated roofs unless the humidity is kept high. After delivery, they should be kept in a humid room for 24-48 hours before filling. Methods of maintaining the proper relative humidity in the storage rooms include letting steam escape into the room; storing bags off the floor and keeping the floor wet; opening windows on damp days; hanging cloths over the edge of a water-filled barrel; and drilling small "needle" holes in horizontal water pipes and hanging cloths over the holes. Many types of commercial humidifiers are available and well worth their cost.

75. Can paper replace jute bags for raw sugar? Modern Packaging 16, no. 7:73, 106(March, 1943); B.I.P.C. 13:322.

A shipping test with 500 multiwall paper bags is described which was made for the transport of 100,000 lb. of raw sugar from Havana to New York via Florida. The bags were of 200-lb. capacity, sewn open-mouth 6-ply gusset type. The outside was made of water-resistant kraft, and one of the inside plies was an asphalt sheet. The test was so successful that, in the opinion of all concerned, paper bags can be substituted for the previously employed jute bags.

76. Canadian Government Specifications Board. National Research Council, Ottawa, Canada.

43-GP-2. Bags; paper (Kraft), S.O.S., grocers'.
43-GP-2a. Bags; paper (Kraft), S.O.S., grocers'.
43-GP-10b. Bags; dessicants (activated) in bags; for static dehumidification and packaging.

77. Carlsen, Earl W. Apple packages. Modern Packaging 21, no. 8:124-8 (April, 1948); B.I.P.C. 18:626.

A report is given on direct market testing of consumer packages of apples and laboratory testing of apple packaging materials conducted by Washington agencies and shippers. MST cellophane, impervious to moisture and air, seems to be an unsafe choice. LST cellophane, less impermeable, can be used with fair satisfaction in the proper gages. Lumarith is still more porous and has some advantages, but will permit the loss of moisture from apples in a dry climate. Many types of Pliofilm cannot be used, although certain gages are recommended for apples to be held for a few weeks. More study of this subject is necessary. In consumer tests, cellophane bags, rectangular over-wrapped boxes, mesh bags, printed bags with and without windows, trays with transparent overwraps, paperboard egg-type window cartons, and Hammock-Packs were used; the results are described. Packages that can take a range of sizes have a distinct advantage. At first prepackaging will undoubtedly increase the cost; however, it is conceivable that it will eventually decrease packaging expense. Whether prepackaging should be done at the shipping point or at the terminal market has not been determined, but must be ascertained before development in this field can proceed much further. Much emphasis is placed on the quality of the fruit, which is more important than the package.

78. Carson, Frederick T. Passage of moisture through packaging materials. Food Ind. 10, no. 1:14-16(Jan., 1938); B.I.P.C. 8:350.

Theories of penetration of moisture through membranes or sheets are briefly discussed. The anomalous behavior of water vapor in penetration is mentioned. Ten important factors influencing a moisture penetration test are discussed, namely time, area, leakage, thickness, vapor-pressure difference, relative humidity, temperature, total pressure, diffusion in still air, and state of moisture.

79. Carson, Frederick T. Testing packaging materials for permeability to moisture. Food Industries 10, no. 3:130-2, 170(March, 1938); Paper Box and Bag Maker 85, no. 5:180, 190(May 10, 1938); B.I.P.C. 8:396; C.A. 33:243; T.S. 108:146.

The author describes briefly various testing methods developed to measure the permeability to water vapor of many different materials, and discusses their relative merits. Test data from 28 published reports are given in two tables. These indicate that there is no definite relation between the permeability to water vapor and to air. Reference is made to the project of the Paper Testing Committee of TAPPI for working out a standardized procedure.

80. Cathcart, W. H. Action of various types of sack on stored flour. Am. Miller 68, no. 10:37(1940); Index. Lit. Food Investigation 16, no. 3:221 (Dec., 1944); Packaging Abstr. 5:531.

Tests were made to examine the effects of cotton, jute, paper-lined and grain bags on the storage properties of bakers' flour. Practically no differences were found in the gain or loss of moisture, ash and protein contents, absorption or baking quality.

81. Cathcart, W. H., and Killen, Edward J. Changes in flour on storage with special reference to the effect of different types of bags. Cereal Chem. 16:798-817(1939); C.A. 34:532.

Two different samples of chemically bleached and matched flour were stored separately in four different types of bags, viz., ordinary cotton, paper-lined, jute and grain. They were stored under average commercial bakeshop conditions. The samples were analyzed at regular intervals for moisture, ash, protein and absorption, and baking tests were made. The kind of bag had little effect on the analyses or the baking quality of the flour. In all cases absorption increased during storage, ash and protein showed no change, and the baking quality in one sample fell off after the fourth month and in the other after the sixth month. Deterioration in the latter case was due to infestation. The effects incidental to storage are in general agreement with the work of other investigators.

82. Cernia, E. Permeability of films of synthetic resins to gases and vapours. Materie plastiche 22:361-70(1956); J. Appl. Chem. (London) 6, no. 10:338, col. ii(Oct., 1956); Packaging Abstr. 14:108.

The method of manufacture of synthetic resin film is outlined, and the principal types of American-made films tabulated. The permeabilities of these films to gases such as hydrogen, nitrogen, helium and carbon dioxide are given in some detail. An analysis is made of the effect on permeability of film thickness, pressure and the molecular weight and degree of crystallinity of the polymer.

83. Chaftan, Sol. Method for treating paperboard. U. S. patent 2,789,921(April 23, 1957); B.I.P.C. 28:161.

Strong, rigid, water-resistant paper and paperboard are produced by saturating the material first with a solution of rosin in an organic solvent, such as methyl ethyl ketone, and then with a solution of methyl methacrylate in a similar solvent. The active ingredients are present in each solution in amounts of 10-30% by weight.

84. Charlton, F. S., and DeLong, R. F. Foods and permeability. Modern Packaging 29, no. 7:227-35, 342, 344, 346(March, 1956); Packaging Abstr. 13: 658, 1075; B.I.P.C. 26:658.

The importance of permeability in the food-packaging industry is discussed; permeability, in addition to being used in connection with the passage of water vapor and gases, is taken to include the passage, through films, of liquids such as water, fats, and oils; gaseous materials such as volatile components imparting flavor and odor to foodstuffs; and electromagnetic waves constituting both the visible and invisible spectra. Water-vapor and gas permeabilities are the most important factors in food packaging; methods for measuring these factors, two mechanisms by which permeation occurs, and the effect of temperature and R.H. on permeability are described. Means for modifying or altering the permeability of a film include coating or laminating with other materials. The most commonly used sheet having improved permeability characteristics by a coating operation is waxed paper or board. The comparative permeabilities of various packaging materials to water, gases, some organic vapors, and ultraviolet rays are listed.

85. Chase Bag Co. Crinkled multiwall bag production expanded. Chem. Eng. News 28, no. 33:2838(Aug. 14, 1950); Chem. Processing 13, no. 8:68(Aug. 1950); Packaging Parade 18, no. 211:66(Aug., 1950); Chem. Inds. 67, no. 2: 311(Aug., 1950); B.I.P.C. 21:42; Packaging Abstr. 7:786.

Reference is made to the increasing use of all-crinkled multiwall paper bags, whose individual plies are made of wet-creped or secondary creped paper so that they retain 12-15% stretch in the longitudinal direction. Three, four, or five-ply bags are produced by laminating the individual sheets with a light coat of pliable adhesive. A feature claimed for these bags is their ability to expand and absorb shock and strain; another advantage is their good stacking quality.

86. Chase Bag Co. Multiwall bag information. Chem. Industries 60, no. 3:464(March, 1947); B.I.P.C. 17:441.

With reference to the shortage of all types of paper, which is further aggravated by the increased use of multiwall paper bags, converters find it difficult to meet the demand for such bags by the fertilizer, construction, and chemical industries. Wet-strength paper is not used as a moisture barrier but because it retains its original strength characteristics to a high degree, even though completely soaked in water for several hours. Ordinary paper disintegrates within a very short time when subjected to wet conditions. Wet-strength paper was used during the war for overslipping cotton bags, the construction including two natural kraft sheets, two asphalt laminated walls for moisture resistance, and an outer wall of wet-strength paper. Synthetic resins and plastics came into general use in a much wider field during emergency conditions; however, the cost of incorporating these materials into kraft paper for ordinary purposes is prohibitively expensive. Under conditions where extreme resistance to grease, oil, water, water vapor, and chemical reactions is required, the added cost may be justified. Because of the relative ease and reduced cost in filling, handling, and storing multiwall bags, their application to other commodities may be expected to increase.

87. Clabe, J. The use of laminated papers for the manufacture of bags. Rev. papiers et cartons 15, no. 19:13-14(Oct., 1952); B.I.P.C. 23: 345(Jan., 1953); Packaging Abstr. 10:356.

The need for the correct selection of the laminating agent and the two plies used in the manufacture of laminated bags is emphasized; the article deals particularly with applications of greaseproof or glassine paper as the inner ply.

88. Claussen, H. P. Factors that influence choice of bag material. Textile Age 9, no. 2:50, 55-6, 58, 60-1(Feb., 1945); B.I.P.C. 15:352.

The volume of business captured by cotton, burlap, and paper bags in relatively few but important areas of competition is dependent largely on price; these bags can be used interchangeably in the packaging of many commodities, such as sugar, flour, fertilizer, and feed, to mention a few. Price as net cost to the bag user consists of three elements: initial price, salvage value or re-use potentialities, and total dollar cost of filling, closing, baling, and otherwise handling the various types of containers. Some of the more important non-price factors are: end-consumer preferences, handling costs of large consumers, nature of product (dusty, odorous, etc.), and degree of protection required against loss by sifting, contamination, etc. Multiwall paper bags have the advantage that they are siftproof, they shed water, and protect contents when stored in the open, whereas textiles under similar conditions disintegrate. In small retail packages (up to 25 pounds), paper has displaced cotton to a large extent for sugar and flour because of highly specialized machinery for automatically handling and packaging small bags. No similar developments are available for handling small cotton bags, because any textile is difficult to handle on automatic machinery and inventive effort has followed the lines of least resistance. The author believes it possible that such machinery for textile bags can be developed; he emphasizes the need of bringing the art of mechanical invention into action at the earliest possible moment to work for cotton in the packaging field.

89. Cloth lined paper. Papier-Ztg. 61, no. 29:624(April 8, 1936); B.I. P.C. 6:407.

Cloth-lined paper consists either of two layers of paper with a tissue reinforcement in between, or of one paper layer backed with cloth. It is used in the bag and envelope industry, for wrapping and similar purposes where strength and resistance to wear are essential.

90. Colombo, P. Refining of sulfate pulps. Assoc. tech. ind. papetière, Bull. no. 4-5:135-42(1955); B.I.P.C. 26:221.

With the object of obtaining a bag paper with high tensile strength, burst and tear resistance, and of maintaining satisfactory drainage on high-speed machines, the author undertook a series of extensive laboratory experiments and mill runs. The pulp used was a Swedish kraft with a TAPPI permanganate number of 23.5 and contained 82.6% α-cellulose and 11.4% pentosans. The physical properties of the original pulp and changes resulting from refining experiments are given in detail. A special study was made of the effects obtained in a laboratory beater, and subsequently in two conical, one disk, and two types of jordan refiners. The general conclusion reached is that neither by a single hydration treatment in the beater nor by one cutting treatment alone could adequate drainage and strength be achieved. However, by means of hydration followed by a cutting operation, the desired results were obtained both in the laboratory and through mill runs.

91. Conti, John D. Cellophane pliability tester. Modern Packaging 29, no. 11:124-5, 183(July, 1956); Packaging Abstr. 13:734; B.I.P.C. 26:979; C.A. 50:15082.

An instrument for measuring the pliability of cellophane, which is based on the principle of cellophane's tendency to stretch in relation to its moisture content, is described.

92. Cooper, Norman H. Progress in developing a standard block test. Paper, Film and Foil Converter 29, no. 2:23-5(Feb., 1955); B.I.P.C. 25:522; Packaging Abstr. 13:348; Printing Abstr. 10:250.

The factors of stability in flexographic printing on cellophane considered most important are blocking, ghosting after printing, operational offset, delayed offset, and bleeding. Since blocking appeared most troublesome, an attempt was made to develop a standard block-test procedure to forecast any blocking tendencies; a progress report on the results obtained to date is presented. Cellophane samples preconditioned for 48 hours at 20, 40, and 60% R.H. were tested under 1, 5, and 10 p.s.i. pressure at a temperature of 100°F. for 24 hours. It was decided that 1 p.s.i. was insufficient to give worthwhile results; 40% R.H. was selected as the standard humidity to be used on future tests, all of which would be run in a single stack. The test procedure used and a tentative procedure for the final round of testing are outlined.

93. Corte, Heinz. Mechanical properties of paper bags. Verpakungs Rundschau no. 8: Suppl. 49-55(Aug., 1955); B.I.P.C. 26:297; Packaging Abstr. 13:214.

This is a statistical study of the stresses to which paper is exposed on bagmaking machines; a mechanical analysis of this type has not yet been made. A bleached chemical-pulp paper with a basis weight of 75 g./sq. m. was prepared on the experimental paper machine of the Waldhof-Mannheim

$\frac{75\,g}{m^2} \times \frac{lb}{453.6\,g} \times \frac{m^2}{100^2\,cm^2} \times \frac{2.54^2\,cm^2}{in^2} = 1.077 \times 10^{-4}\ lb/in^2$

$1.077 \times 10^{-4}\ lb/in^2 \times 41.2 \times 10^{4}\ \frac{in^2}{24 \times 36 - 500} = 44\ lb/24 \times 36 - 500$

research laboratory (machine width one m.); by varying the furnish and operating conditions, about 20 different paper qualities were produced. The physical properties of these papers were tested according to well-known procedures and showed a wide variation. Flour bags of one kg. capacity were formed upon three types of bag machines with different facilities for forming the folds and the loss in bursting strength on the bends and folds of the bags was measured and compared with that of the nonstressed paper. The results indicated that all three machines subjected the paper to considerable stresses which were alike in their physical nature. The degree of stressing depended upon machine adjustments and varied within the same machine type. The best correlation with the bursting strength values was found with stretch, internal tear (Brecht-Imset), and folding endurance (Brecht-Wesp); all other paper properties tested showed no significant correlation and were not considered further. The bags were then filled with one kg. of peas each and dropped from a height of 27.5 cm. onto a slightly inclined plane so that the bottom edges were preferentially stressed; the intact bags were dropped a second time from the same height, but this time on the sides. Bags which had not burst after these experiments were dropped from a 7.5 cm. greater height in the same positions reversed by 90°, with further increases in height until all bags had failed. A good correlation between weakening of the paper on the bag machines and failure during drop tests could be established. A comparison between drop tests and trial shipments by rail (eight bags filled with peas packed in each Zewa shipping container) showed the same tendencies as indicated by the drop test; however, the test material was not sufficiently large for statistical evaluation. The statistical procedures employed for mass correlation are described in some detail; a few data on Spearman's rank correlation and its use in general and in this specific case are included.

94. Corte, H., and Schoch, W. Paper for packing of hygroscopic food. Neue Verpackung 8, no. 10:489-92, 494, 496(Oct., 1955); Food 24, no. 290: 427-8(Nov., 1955); Packaging Abstr. 13:4.

The article reports on work carried out at the Research Laboratories of the Cellulose Works at Waldhof, Germany. Isotherm-curves are presented for coffee extract, candies, biscuits, cocoa, milk-powder and chocolate, which cover a temperature range from 0 to 35°C. and relative air-humidities between 0 and 100%. Special attention is paid to the significance of seams, folds, angles and corners for admitting humidity. Formulas are presented which enable the shapes of paper bags providing the best protection against water-absorption to be calculated. The advantages and shortcomings of impregnated paper are weighed against those of transparent plastic films.

95. Cotton, R. T. The insect problems of dried food storage. Proc. Inst. Food Tech.:49-53(1945); B.I.P.C. 16:334.

To preserve dried processed foods from insect damage, it is essential, first, to manufacture insect-free products and, second, to use insectproof packages. Many types of bags or cartons used for this purpose offer little protection from insect attack. Fabric bags do not protect against insect infestation; in many cases, they can be replaced by paper bags of single or multiwall construction. All seams of paper bags should be cemented and sewed tops and bottoms should be protected by strips of gummed tape or other covering. Cartons sealed and covered, either with a wet wrap which completely covers the closure or with a coating of paraffin wax, are best for excluding insects. A few insects which have wood-boring habits, such as the cadelle, will attack successfully any type of package unless the wrapping or covering is impregnated with a repellent chemical. The cadelle will cut through a multiwall paper bag or a metal-foil wrapped carton overnight. Insect-repellent chemicals may aid materially in keeping insects out of susceptible packaged products. These repellents may be used to impregnate one of the plies of multiwall paper bags, the liquor used to prepare coated kraft paper, or the paper used to make single-wall bags. Protective coatings of wax or similar materials may also be supplied with repellents. The rest of the article deals with the food, moisture, and temperature needs of stored-food insects and their habits in general, as well as with warehousing of susceptible foodstuffs not stored in containers.

96. Cotton, R. T., Balzer, A. I., and Young, H. D. Possible utility of DDT for insect-proofing paper bags. J. Econ. Entomol. 37:140(1944); C.A. 38:5331; Packaging Abstr. 3:430.

Preliminary tests with DDT-impregnated paper suggest that multiwalled paper with one ply impregnated with DDT, or coated kraft paper prepared by incorporating DDT in the coating liquor, may prevent insects from cutting through the paper.

97. Cotton versus the multi-wall paper sack. Freight and Sales Appeal, p. 53-4, March, 1948; Packaging Abstr. 5:219.

The various uses and the relative merits of cotton, burlap and paper sacks are discussed.

98. Couch, Robert de S., and Muldoon, T. J. Impact-fatigue test for paper. Modern Packaging 24, no. 4:131-5, 180, 182(Dec., 1950); B.I.P.C. 21:338.

Because drop tests and other strength tests for paper show little correlation, it is not practical to predict bag performance on the basis of any one of these tests. A new impact-fatigue test is described which takes into account the series of small impacts to which packages are subject in shipping. The impacts in this test are applied by dropping metal balls through a tube onto a rigidly held piece of paper. The number of balls required to break through the paper is used as an indication of the impact-fatigue strength. Good correlation is obtained between this test and the drop test, and it appears to predict with fair accuracy the performance which may be expected from the paper. Certain conditions and variables in both the impact-fatigue and drop tests are discussed, and data are given in tables and diagrams on test results. A detailed outline of the test method is appended.

99. Couch, Robert de S., and Muldoon, Thomas J. Impact-fatigue testing of packaging materials and containers. U. S. patent 2,699,672(Jan. 18, 1955); B.I.P.C. 25:589.

An apparatus for testing the impact fatigue resistance of flexible packaging materials (to be used in the construction of bags or similar containers) when exposed to repeated blows or stresses in commercial use is claimed. A section of paper used in making a bag is supported peripherally in an approximately horizontal position; its unsupported central portion is subjected to a series of repeated impacts by dropping weights thereon in succession. The size of the weights and the height from which they are dropped are adjusted with respect to the initial strength of the container-wall section, so that each impact is substantially less than that required to cause rupture of the section in its original condition. The number of impacts which the wall will withstand without rupture is a reasonably accurate indication of the actual performance of the container in field usage.

100. Cowan, John M. Design for impact. Modern Packaging 21, no. 8: 140-2, 286, 288(April, 1948); B.I.P.C. 18:575.

When use is made of a transparent wrap, the type elements should be massed on panels of contrasting colors, and a brand name or trademark printed with a color outline behind the type. An attempt should be made to play up some design element, color, or color panel, so that the package is readily remembered; clean bright colors appeal to a mass market. A second or third color adds little to the printing cost and usually improves the appearance of the package. Bags intended for display when stored flat or stapled to display boards should have a wide face in comparison with the side plies. If the bag is to be stacked, some identification must be on the bottom. The package designer should be familiar with competitive and formerly used packaging, the appearance of the product to be packaged, letterheads, labels, etc. To check design effectiveness, the bag may be filled and closed, placed as if in a store display, surrounded with competing brands, and its general appearance and the visibility of the type determined from some distance. Methods of testing the efficacy of the design are suggested.

101. Crandall, Henry C. Method of impregnating fibrous materials. U. S. patent 2,767,088(Oct. 16, 1956); B.I.P.C. 27:762.

A moldproof paper contains as the fungicide 0.01-5%, based on the dry weight of the papermaking fibers, of copper pentachlorophenate. The fungicide may be preformed and added to the fiber suspension in the beater or it may be precipitated on the fibers from sodium pentachlorophenate by addition of copper sulfate. The pH of the stock should be at least 4.5; rosin size and/or 0.01-5%, based on dry fiber weight, of a substantive agent, such as tetranaphthenoyl tetraethylene tetramide, succinonitrile, glutaronitrile, or adiponitrile, should also be added at the beater.

102. Creped paper for bags. Papier-Ztg. 61, no. 96:1806(Nov. 28, 1936); B.I.P.C. 7:155.

Reference is made to the use of creped paper for bags and other wrapping purposes. The best results with regard to elasticity, bursting strength, and elongation can be obtained when the creping is carried out upon a separate machine and not upon the original paper machine. Such machines have various speeds and are equipped to crepe paper of different thickness and furnishes; some crepe the paper also in the cross direction. They must be able to crepe bituminous papers without splitting of the two webs united by the tar. A prerequisite of faultless working is that the bituminous coat is applied in a sufficiently thin layer without impairing the bonding strength of the adhesive.

103. Crown Zellerbach Corp. Double-strength bag. Packaging Parade 23, no. 275:97(Dec., 1955); Packaging Abstr. 13:214.

Improved protection is given by this long fiber kraft, polyethylene-coated bag, which has a unique back seal. The contents of the bag touch only the polyethylene coating, which prevents them from sticking.

104. Cushioned mailing bag for books. Modern Packaging 23, no. 7:80 (March, 1950); B.I.P.C. 20:588.

A single-book mailing bag is made of laminated, moisture-resistant kraft with shredded paper between the outer and inner bag walls as a cushioning material. The bag protects against rough handling and moisture, and its cost and postage charge are the same or less than that for conventional mailer cartons.

105. Cutler, Janice A., and McLaren, A. Douglas. Permeation through and sorption of organic vapors by high polymers. Tappi 36, no. 9:423-5(Sept., 1953); B.I.P.C. 24:128: Packaging Abstr. 10:879.

Sorption data are reported for organic vapors in polymeric materials (polyvinyl alcohol, polystyrene, Geon, saran, Teflon, polyethylene, and nylon). From these data and previously published permeation data, diffusion constants are calculated. The sorption data are also analyzed from the point of view of current sorption and solution theory.

106. Dahlen, C. O. Developments in the testing of sack papers. Paper Box Bag Maker, Aug., 1954:76-7; Paper Market, Aug., 1954:39-40; B.I.P.C. 25:217.

Excerpts from the author's booklet "On the quality and testing of sack paper" are given in which methods are very briefly described for testing tensile strength, stretch, burst, and tear, with reference to static and dynamic stresses and Steenberg's work on the visco-elasticity of paper. The superiority of sack paper with high stretch under rapid stresses(repeated drops or falls) is emphasized.

107. Davis, Dean F., and Laudani, Hamilton. Long-term insecticide tests. Modern Packaging 29, no. 7:236-40, 332, 334, 337-8(March, 1956); B.I.P.C. 26:633; C.A. 50:9679.

The authors describe tests which were conducted at the Savannah, Ga. laboratory of the U. S. Department of Agriculture over a period of 18 months to determine the effectiveness and duration of several insecticide treatments (methoxychlor, lindane, pyrethrum and piperonyl butoxide, pyrethrum and sulfoxide, and allethrin and sulfoxide) applied to paper and cloth bags. All of the paper bags were of three-ply construction with 50-pound kraft paper used in all plies; most of the bags were of the sleeve-valve types with two series of open-mouth types. The insecticide treatment was applied to the outside ply only in the form of a wettable powder in clay coating. Some of the bags were closed with treated tape or thread. The bags were filled with flour and stored in two rooms for exposure to 15 species of stored-product insects. At three-month intervals for 18 months, four bags of each treatment and of the controls were removed from the storage rooms and inspected for insect penetrations and infestation. Analysis of the results showed that none of the treatments was sufficiently effective to prevent insect entrance into the bags through the needle punctures and through the sleeve valves of the valve-type bags. More penetrations and more insects were obtained in the sleeve-valve bags than in the open-mouth bags. Cloth bags proved to be less effective than paper bags in long-term protection. The results of this large-scale storage test corroborated results of previous tests as to the success of the pyrethrum-piperonyl butoxide treatment. They also showed a comparatively high degree of effectiveness for the lindane and methoxychlor treatments. After 9-12 months' exposure there was a rapid and sharp decrease in the effectiveness of the pyrethrum treatment; this did not occur with the chlorinated hydrocarbon treatment. Treated tape and thread at the end closures reduced the number of insects which entered the bags through the needle punctures. It may be possible to obtain maximum exclusion of insects by completely sealing the needle punctures with treated waxes or a self-sealing plastic compound. The mechanical exclusion of insects is necessary if the maximum effectiveness is to be obtained from an insecticide-coated bag.

108. Day, F. T. Papers for case, sack and bag liners--specialty packing papers. Packer & Shipper 4, no. 9:20-2(Sept., 1954); Packaging Abstr. 11:1024.

A variety of papers is defined. Some indication is given of general uses.

109. Denholm, D. H., and Wicks, C. S. Impact testing of polyethylene film. Paper, Film and Foil Converter 30, no. 9:19-21(Sept., 1956); B.I.P.C. 27:123; Packaging Abstr. 13:928.

The authors report on some basic research conducted to help in evolving a set of standard operating specifications for polyethylene--especially in respect to impact testing. A falling ball drop technique and tester were developed; details of both are outlined. One of the outcomes of the investigation was the realization that a film very high in impact almost always is excellent in tear and crease resistance.

110. The desirable properties of chemical pulp for paper manufacture and methods for their characterization. Svensk Papperstidn. 51, no. 4:95-103(Feb. 29, 1948); B.I.P.C. 18:778.

Desirable pulp properties for wrapping, bag, kraft liner, spinning, newsprint, and greaseproof papers are enumerated.

111. Determination of the gas permeability of plastic films by means of the measurement of change of pressure and volume. Kunststoffe 46, no. 4:143(April, 1956); Metal Box Co. Ltd., Research Division of the Survey of Literature, April, 1956:14; Packaging Abstr. 13:822.

In the method described, gas permeability is measured by means of instruments in which a capillary mercury column is moved through variations of pressure or volume. Sensitivity, accuracy and lower limit are expressed as functions of pressure, temperature, volume of the gas and as functions of the variability and accuracy of reading of these dimensions. The accuracy of three instruments of different sizes was determined by experiment and was found to agree within narrow limits with the calculated accuracy.

112. Develops wet strength bag. Am. Paper Merchant 43, no. 9:34 (1946); Packaging Abstr. 3:756.

A paper bag has been developed which resists the "sweat" of chilled beverages, such as milk, beer and carbonated waters. The new bag, called the Dolphin, made of wet-strength paper which absorbs moisture, makes certain that sweating merchandise will not disintegrate the paper. Even if saturated, the bag holds together. The paper is treated with special moisture-resistant chemicals during manufacture. The seams of the bag are sealed with a specially developed adhesive which can be immersed from 4 to 48 hr. in water without losing its grip. During the war, special waterproof bags sealed with this adhesive were used to float supplies ashore from landing craft.

113. Dingerling, Walther. Paper bags and their applicabilities. Verpackungs Rundschau 7, no. 6: Suppl. 45-51(June, 1956); B.I.P.C. 27:682.

Papers used for the manufacture of paper bags (soda sealing paper, soda kraft paper, light crepe, bleached and semibleached kraft, bitumen-coated paper, and plastic-coated papers), paper bag types (sealed cross-bottom bag, block-bottom bag, stitch-bottom folding bag, flat-folding bag, and sealed or stitched valve bags), bag properties, filling machinery, applications, bag testing and storage, and directions for the handling of paper bags are discussed.

114. Do you want a private product to sell? Paper Sales 6, no. 3:18, 46, 48, 50(March, 1946); B.I.P.C. 16:344.

The jack-of-all-trades nature of multiwall bags makes them easy to sell, in spite of the fact that they are more expensive than other bags. There are some jobs which cannot be done without them, and many others which multiwall bags can do much better than any other type of packaging. Manufacturers have to know practically everything about the product to be packaged in order to incorporate the correct combination of plies suitable for the specific purpose. Some of the questions which have to be answered are the nature of the product, whether fine, coarse, powdered, or liquid, so that it can be poured; temperature of filling; flow characteristics when it has hardened; moisture content and affinity for moisture; possible chemical reactions; toxicity; type of shipping, i.e., carload, truck, or air freight; peculiarities of storage requirements, if any; handling conditions to which it will be subjected; etc. Some of the functions which a multiwall bag can be made to perform include: protection against moisture from the atmosphere or loss of moisture through evaporation; protection against water, loss of flavor or essential oils; protection against insect infestation or bacterial contamination; prevention of seepage or sifting; protection from abrasion and scuffing from the outside.

115. Doty, Paul M., Aiken, Wm. H., and Mark, Hermann. Water vapor permeability of organic films. Ind. Eng. Chem., Anal. Ed. 16, no. 11:686-90(Nov., 1944); B.I.P.C. 15:137.

An apparatus for a rapid, precise, and reproducible determination of water-vapor permeability is described. It seems that two factors, diffusion velocity and solubility, together determine the vapor permeability of a film. Both can be derived from the measurements. Equations based on the validity of Fick's law were tested with commercial films of low permeability. The dependence of permeability on thickness, vapor pressure, and temperature was studied. On the basis of measurements of a number of films, a discussion of the process of permeation is presented.

116. Doyle, James F., and Onasch, Paul L. Laminated material and bags and linings made therefrom. U. S. patent 2,790,592(April 30, 1957); B.I.P.C. 28:129; Packaging Abstr. 14:933.

A composite web, made of one or more layers of paper and one or more layers of polyethylene laminated together, is passed through a tank of hot water and subjected to the action of conventional crinkling and corrugating apparatus to produce a highly elastic bag material.

117. Doll, H. Plastic films, their differentiation and gluing. Verpackungs Rundschau 7, no. 10:538-41(Oct., 1956); B.I.P.C. 27:550.

Composition trade names, properties, applications, identification tests, and suitable adhesives are given for cellulose hydrate, weatherproof cellulose hydrate, cellulose acetate, cellulose acetobutyrate, polyvinyl chloride, polyvinylidene chloride, polyethylene, polyamide, and polyester film. For brush application, the type of adhesive used is not critical; however, emulsion-type adhesives are more suitable than adhesive lacquers for machine application. Two new principles of using adhesive lacquers in machine gluing are in the experimental phase of investigation. One is based on viscosity control, and the other on the Opi-A 54 adhesive applicator, in which solvent evaporation is prevented.

118. Durgin, Albert G. Coarse papers, bag and board. Paper Trade J. 135, no. 20:329-30, 332-4, 336-7(Nov. 14, 1952); B.I.P.C. 23:253.

This is one of a second series of industrial lectures on pulp and paper manufacture presented at the University of Maine.

119. Edwards, Fred I., Jr., and Cueto, Cipriano. Estimation of pyrethrins on coated paper bags. Anal. Chem. 24, no. 8:1357-9(Aug., 1952); C.A. 46:11559; B.I.P.C. 23:12.

The Lord colorimetric method for estimating pyrethrins (I) was adapted to determine the (I) present in coatings on bags used to store foods. Extraction of the alcohol extract of the paper with Skellysolve F was necessary to separate the (I) from insecticidally inert compounds and esters in the paper and its sizing. It is recommended that control analysis be run on untreated kraft paper of the same origin as the treated bags.

120. Egan, Walter. Slip ratings for films. Modern Packaging 29, no. 4:143-9, 226, 229-31(Dec., 1955); B.I.P.C. 26:383.

Good slip is required of a plastic film to facilitate bag making, overwrapping operations, and handling of the film in general. Two methods of measuring the coefficient of friction of plastic films and laminates are described--the inclined-plane method utilizing measurement of the minimum angle which is required to initiate sliding of the sample and the moving-film, stationary-sled method wherein a pair of motor-driven rolls and a calibrated spring measure the frictional force exerted at the interfaces of the test samples at incipient sliding and during constant sliding. Temperature and humidity, contact pressure, and linear velocity were found to affect the results. A tentative scheme of classifying polyethylene films according to slip has been developed; polyethylene- and vinyl-coated papers in comparison with unsupported polyethylene show that the polyethylene side of one sample approached commercial unacceptability, whereas the remainder of the samples were declared to be probably outside the range of usability. No objection was raised to the slip of vinyl-coated paper.

121. Ellickson, B. E., Hasenzahl, V., and Hussong, R. V. Gas-transmission measurement. Modern Packaging 27, no. 11:173-5(July, 1954); B.I.P.C. 24:1003; Packaging Abstr. 11:944.

A single practical method of testing a number of different films in a few days is reported; the apparatus employed includes a gastight container, acrylic forms, Orsat gas-analysis apparatus, a Pitts manometric gas analyzer, and gas-collecting apparatus. Films which have been creased, folded, and heat sealed around the acrylic forms in the same manner in which small retail food packages are handled can be tested for the passage of gas from the inside to the outside or vice versa. The method of test is described, and data are presented on the permeability of oxygen and carbon dioxide gas through six different films—cellophane laminated to itself, aluminum foil (I), saran (II), or Pliofilm, wax-coated saran (III), and heat-sealing cellophane. The experiments showed that (I), (II), and (III) were impenetrable to the test gases, that the gas which permeated the other films was able to pass in either direction, and that the value of the method lies in its adaptability to practical conditions.

122. Elmore, F. B., Jr. The Van der Korput tensile-strength tester. Tappi 41, no. 5:155-7A(May, 1958).

The Van der Korput tensile-strength tester was investigated for the measurement of the work involved in breaking a strip of paper by the free fall of a pendulum. The instrument shows promise of measuring work to break and at the same time appears simple and rugged enough for use in control testing. A comparison was made of the Van der Korput with the Schopper tester for testing tensile and stretch; the data indicate that the two instruments give comparable results on an average basis for these properties.

123. Enter stretchable paper. Modern Packaging 31, no. 7:159(March, 1958); B.I.P.C. 28:1372.

One of the first examples of the packaging applications of Clupak, the new stretchable kraft paper, is described. At Consolidated Rendering Co., Lowell, Mass., fertilizer is now packed in two-wall stretchable bags that save 16-17% of the paper used in conventional four-wall bags.

124. Essig, E. O., Hoskins, W. M., Linsley, E. G., Michelbacher, A. E., and Smith, R. F. A report on penetration of packaging materials by insects. J. Econ. Entomol. 36, no. 6:822-9(Dec., 1943); Modern Packaging 17, no. 11: 109-13(July, 1944); B.I.P.C. 14:401.

In order to provide insects for testing the resistance of packaging materials to the attack of stored-products pests, colonies of 32 species of these insects have been established. The general methods of rearing are discussed. Tests of resistance to penetration were carried on according to three techniques: (a) exposure of small packages or flat sheets of various packaging materials to one or several species, (b) similar exposure of commercial packages, (c) exposure of small bags or flat sheets of paper towelling impregnated with wax plus any desired chemical to test possible repellent effect. The following tentative conclusions were drawn from this preliminary work: With some insects, penetration of package materials permeable to odors is apparently favored by the presence of food. Insects with propensity for boring are apparently the best penetrators of packaging materials. With the exception of the saw-toothed grain beetle, at least one stage of each of the common stored-food pests was able to penetrate some of the materials tested. None of the commercially used metal-substitute packaging materials tested is strictly insectproof. An abrasive paper is still under test. The most promising material so far tested is a heavy cardboard carton double-dipped in a thermoplastic material. Among the more promising transparent cellulose materials are such products as Thermophane A and Cellophane 600; however, they are only relatively more resistant. Laminated kraft-asphalt-leadfoil-cellophane bags showed little resistance to insect penetration. Among the multiwall bags, the Bemis bag was the most promising, although it was readily penetrated by the cadelle. Manufacturing techniques are needed which will produce uniform containers without roughened spots, creases, folds, and similar areas where insects penetrate most easily. Repellents offer a possible solution; toxicity is shown by many compounds, obscuring the effects due to repellency.

125. Fabre, G. The permeability of plastics. Industrie plastiques mod. (Paris) 7, no. 4:33-5; no. 5:41-3; no. 6:35-8(1955); Brit. Plastics Federation Abstr. 10, no. 5:387; no. 6:481; no. 8:629(May, June, Aug., 1955); Packaging Abstr. 12:619, 789, 893.

The effects of structure and molecular weight, thickness, heat, fatigue, etc., on the permeability of films of thermoplastic materials are discussed and tabulated. Many references are given.

126. Fachet, J., and Plimpton, F. T. P., Jr. Tension testing of paper in industry. Am. Soc. Testing Materials, Spec. Tech. Publ. 194:73-9(1956); discussion 79-80; C.A. 51:8435; Packaging Abstr. 14:746.

127. Fahy, E. F., and MacConaill, M. A. Optical properties of cellophane. Nature 178:1072-3(1956); C.A. 51:6145.

Cellophane exhibits the property of behaving like a half-wave plate; contrary to present theory, this is apparently a surface phenomenon rather than a thickness effect.

128. Fairchild, Don. Industrial paper bags and flexible packaging. Univ. Illinois Bull. Eng. Exp. Sta. Circ. Ser. No. 56:66-70(April, 1949); B.I.P.C. 20:191; Packaging Abstr. 7:145.

The trend toward flexible packaging means smaller unit packaging and more protection for each package. The small unit reduces the amount of spoilage when the contents are contaminated and is easily handled. Package specifications set up by the government during the war are still standard for most industries; the number of such specifications will probably increase and they will very likely be standardized for regular domestic and export shipments as well as for government purchases. The bag-in-box is described, which usually consists of a corrugated carton or fiberboard box with bags of kraft, waxed, coated, or parchment papers, plastic films, or laminates. The possibilities of polythene are emphasized.

129. Fehrlin, A. The activities of the paper division of the Eidg. Materialprüfungs- und Versuchsantalt in St. Gallen. Textil-Rundschau 7, no. 11:527-9(Nov., 1952); B.I.P.C. 23:331.

The principal activities of the paper division of the Swiss national bureau of standards are outlined, including chemical and physical paper testing, evaluation of printing papers and packaging materials, and the development of standard testing procedures. A few typical examples of problems are given with which the bureau has to deal (cooking of straw pulp suitable for paper manufacture; testing procedures for bags, spinning paper, and antitarnish tissue wrappings; evaluation of special food wrappings; and required properties of safety papers).

130. Flexible containers...their future place of prominence. Modern Packaging 18, no. 8:89-93(April, 1945); B.I.P.C. 15:379.

With reference to the formation of the Flexible Packaging Institute in August, 1943 and the activities of its members--makers of highly specialized bags and envelopes--flexible containers are defined as different from ordinary bags and envelopes in that they are custom-made to do a protective job. They may be made from any flexible material--paper, cellophane, plastic film, metal foil, or any combinations of such materials to do a specific job for a particular product. They may be moistureproof, greaseproof, lightproof, odorproof, leakproof, siftproof, insectproof, mildewproof, or may be provided with a combination of these properties, depending upon the requirements of the product. For civilian use, as sales and shelf units, they are usually printed by any of the established printing methods. One of the aims of the association is to promote the use of flexible containers for postwar applications; a few examples are described, including bags for packaged ice, automobile parts, meat, shoes, coal, frozen food, and coffee, and small one-portion and large institutional-size bags.

131. Flexible packaging fights rust. Am. Paper Merchant 42, no. 5: 18-19, 40(May, 1945); Am. Paper Converter 19, no. 5:8-9, 20(May, 1945); B.I.P.C. 15:379.

Many problems of ordnance packaging involving corrosion hazards have been solved by flexible containers of flat, square, satchel-bottom, and automatic styles, employing kraft, wet-strength kraft, asphalt treated-kraft, cellophane, cellulose acetate, vinyl resins, Pliofilm, metal foils, glassine, parchment, etc., sometimes in specially coated or lacquered form, and frequently laminated from two or more sheets. These flexible containers are filled by hand and heat sealed, parts to which a rust preventive has been applied being wrapped in greaseproof paper first. All parts are identified by placing a label between the two thicknesses of the bag, a chipboard or cardboard sheet being included in the larger sizes to prevent bending. The heat-sealed bags are carried by a conveyor to the assembly line for packing in a larger container. This method of assembling and distributing small machine parts will find ready postwar application in the automobile and similar industries.

132. Foex, Lucien. Paper sacks and food hygiene. Rev. papiers et cartons 16, no. 20:5-6, 8(Oct. 15, 1953); B.I.P.C. 24:300.

The author emphasizes the hygienic aspects of single-use paper bags and sacks as compared with textile bags and quotes the opinions of various agencies in different countries.

133. Freeman, A. J., Sheridan, L. W., and Renfrew, M. M. Plastic films at low temperatures. Modern Packaging 27, no. 10:147-51, 216, 218(June, 1954); B.I.P.C. 24:911; Packaging Abstr. 11:848.

Experiments in the development of giant plastic balloons for probing the stratosphere are discussed; tests are described and data presented on the low-temperature toughness (brittleness and resistance to tearing or puncture), gas permeability and porosity, and the effect of flexing of plastic films. In the toughness tests differentiation was made between polyethylene films, polyethylene-polyisobutylene blends, polychlorotrifluoroethylene (Kel-F or Trithene), polytetrafluoroethylene (Teflon), Mylar (I) (a condensation product of ethylene glycol and terephthalic acid), special laminates, and irradiated polyethylene. The following generalizations were made: high-intensity irradiation increases low-temperature and room-temperature puncture and tear strength up to 20%, tensile strength also is increased 10-20%, and the cold-brittleness temperature is not lowered markedly. Permeability information is presented on (I), which has been attractive for potential balloon fabrication partly because of its very low gas permeability.

134. Freidlin, Y. A., and Smirnov, V. A. Cellophane and its testing methods. Bumazh. Prom. 18, no. 11:43-48(1940); C.A. 38:252; Khim. Referat. Zhur. 4, no. 6:119-20(1941).

Transparency, hygroscopicity, content of moisture and glycerol, and the titer (weight of sq. m.), determines the quality of cellophane. The content of glycerol was determined by the Gener method, the tensile strength and elongation on a Schopper dynamometer and the resistance to bending by the method used for paper. The air and water permeability were tested on a combination apparatus used for testing fabrics, and the transparency was determined with the Tsvetkov color meter.

135. Friend, Gordon. Specialty flexible containers. Packaging Catalog, 1944:169-70; B.I.P.C. 15:61.

The specialty flexible container is a highly specialized form of bag or envelope using many and varied types of material. The bags are almost always printed in multicolor designs; however, their most important function is the ability to protect perishable commodities from becoming rancid, stale, or losing their freshness and quality. Prior to 1920, manufacturers had but few films at their disposal, such as glassine, greaseproof parchment, dry wax, and vegetable parchment. New techniques, such as coating glassine or laminating it to other agents, the use of cellophane bags, mounted or unmounted metal films, new laminations, and many new plastics have helped since then to expand the industry, in spite of the fact that many of these innovations are at present not obtainable. One of the most interesting developments has been the art of making bags by heat sealing.

136. Frozen victory gardens--a new trend in packaging. Modern Packaging 17, no. 4:61-7, 154(Dec., 1943); B.I.P.C. 14:145.

Present and possible future trends in packaging for lockers are discussed. Standardization of container sizes and packages is an important requirement and should be carried out in relation to the following fundamentals: protection, structural strength, ease in handling, trade satisfaction, and cost. Proper packaging materials must prevent desiccation and oxidation, as well as the absorption of outside flavors, odors, and contamination. They must not crack or become brittle at low temperatures. The bag-in-carton type must be leakproof, stainproof, easy to fill, and have an effective seal. No matter how good the packaging material employed, no package is better than its closure. The ideal package for frozen food will vary according to the material to be preserved; present methods for fruits, vegetables, and meats are outlined. Numerous illustrations are included in the article.

137. Frukhtbeĭn, M. A. General Soviet standards for paper used in the production of (portland) cement bags. Tsentral. Nauch.-Issledovatel. Inst. Bumazh. Prom. Materialy no. 29-30:247-60(1940); C.A. 34:8279.

The standards for quality and methods of testing are described and discussed.

138. Fujiwara, Yukio. Studies on the strength of kraft paper. II. Influence of the tension during drying on the mechanical properties of the paper sheet. (1). J. Japan. Tech. Assoc. Pulp Paper Ind. 10, no. 11:592-6 (Nov., 1956); B.I.P.C. 27:839.

Kraft pulp of Roe no. 5.8 and beaten to a Canadian freeness of 400 ml. was made into isotropic wet handsheets. These were dried under various tensions, using an electric heater, to give a basis weight of 83 g./sq. m. at 8% moisture content. With transverse tension fixed at 10 g./cm., tensile strength in both directions increased with longitudinal tension over the range from 10 to 250 g./cm. and thereafter decreased to 300 g./cm. With transverse tension fixed at 50 or 100 g./cm., tensile strength in the longitudinal direction increased over the entire range of longitudinal tension from 10 to 300 g./cm., whereas tensile strength in the transverse direction decreased at low values of longitudinal tension. With increased longitudinal tension, breaking elongation in the longitudinal direction decreased appreciably, whereas elongation in the transverse direction increased linearly. Dry-shrinkage values paralleled the course of breaking elongation with changing longitudinal tension, indicating a close relationship between breaking elongation and dry shrinkage. Bursting strength varied with longitudinal tension in a manner nearly predicted by the theoretical equation developed in the first part of the study.

139. Gabler, R. The permeability of plastic films to solvent vapours. Kunststoffe Plastics 3, no. 1:5-12(1956); Brit. Plastics Federation Abstr. 11, no. 12:949(Dec., 1956); Packaging Abstr. 14:109.

A method is given for determining the vapor permeability of a number of plastic films to organic solvents. The materials examined include cellulose, polyethylene, polyvinylidene chloride, terephthalate polyester and polyamide obtained from caprolactam. The results are discussed and tabulated.

140. Gadsden, J. Coating bags or sacks filled with dusty materials. U. S. patent 1,258,104(March 5, 1918); C.A. 12:1414.

Sacks which are to be filled with dusty materials such as superphosphate or cement are rendered relatively impervious to dust and water by spraying the interior of the sacks, just before filling them, with an adhesive liquid which forms a coating or filling together with the dusty material with which the sack is filled.

141. Geimer, William J. Waterproof bag. U. S. patent 2,435,743(Feb. 10, 1948); B.I.P.C. 18:489; Packaging Abstr. 5:219.

In a multi-ply type of bag, the outer supporting member is preferably of nonwaterproof material and the inner pillow-like bag is constructed of a relatively thin, flexible textile material which is coated or impregnated with a suitable waterproofing agent (e.g., a vinyl resin). The inner bag is relatively larger in size than the outer supporting member so that, when the inner bag is hermetically sealed and the outer member is closed, all strains and stresses exerted on the walls of the sealed bag will be taken up entirely by the walls of the outer member. This arrangement permits rough handling of the bag without danger to the inner bag and its contents.

142. Gelber, Philip A., and Bowen, J. Hartley, Jr. Flexing-test device. Modern Packaging 25, no. 5:125-8, 178-9(Jan., 1952); B.I.P.C. 22:428.

The development of a method for the evaluation of flexible water-vapor-proof barrier material is reported, and the instrument which was employed, the Gelbo flex tester, is described. The transmission-rate tests which were carried out indicate that the tester is quite sensitive to changes in material and that it can be utilized in this manner, as well as for evaluating the critical performance of a material. The test results also indicate that the tester is capable of duplicating to a remarkable degree the service-application damage on the barrier materials.

143. General Services Administration. Federal Supply Service. Federal standard stock catalog. Federal specifications. Jan. 1, 1958.

JAN-S-114. Sacks; shipping, paper, multiwall (domestic).
L-B-74. Bags; wet-dressing.
MIL-B-1190. Bags; shipping, multiwall (for portland cement).
MIL-B-1408. Bags; paper, clothing, mailing.
PPP-B-30. Bags; shipping, cushioned.
PPP-S-0048. Sacks; paper, shipping.
PPP-S-0050. Sacks; shipping, paper, reinforced.
PPP-S-50a. Sacks; shipping, paper, reinforced.
UU-B-36e. Bags; paper (grocers').
UU-S-48b. Sacks; paper, shipping.

144. Gigliotti, Mario E., and Weiner, Howard M. Polyester in barrier materials. Modern Packaging 30, no. 7:225-9, 336, 338(March, 1957); B.I.P.C. 27:1417.

A study was made of the suitability of polyester film laminates as military greaseproof barrier materials. Two grades of material were tested--one a lamination of 50-gage polyester film to high-strength kraft paper and the other a lamination of 100-gage polyester film to a cotton scrim with a special, high melting point wax mixture. The first material complied with all applicable requirements of military specification MIL-B-121A, except for moisture content (5.6%) which exceeded but slightly the maximum permitted value of 5%. This slight excess and a slight wrinkling and puckering of the film on elevated-temperature aging were presumably caused by insufficient drying of the laminant and can be easily corrected. The second material was not acceptable, because the scrim delaminated from the polyester film during low-temperature flexing, but a change in the wax formulation to increase low-temperature flexibility is expected to overcome this problem. The emergence of polyester film laminates as full-fledged military barriers is attributed to greater availability and a resultant drop in price, the more stringent requirements of the more recent specifications, and recent improvements in the technology of polyester film.

145. Gobbo, V. Testing p.v.c. films. Materie plastiche 22, no. 5: 398-404(1956); Brit. Plastics Federation Abstr. 11, no. 12:955(Dec., 1956); Packaging Abstr. 14:109.

Methods are given for determining the properties of supported and unsupported polyvinyl chloride films. Diagrams show some of the apparatus and test methods used.

146. Grabovskii, V. A. Paper bags. Methods of impregnation of paper for the production of water- and air-impermeable paper containers. Tzentral. Nauch.-Issledovatel. Inst. Bumazh. Prom. Materialui no. 1:106-38(1935); Papier-Ztg. 61, no. 56:1073-5(July 11, 1936); C.A. 30:3230; B.I.P.C. 7:22.

Of the methods of impregnating different grades of paper with various materials for the production of paper bags with sufficient degree of water- and air-impermeability, the impregnation with solutions of bitumen in mineral oils (preferably in lubricating oil) is the most satisfactory. Mixtures of equal parts of bitumen and oil give the best results. The ratio of bitumen and oil in the mixture can be varied, according to the properties of paper, from 25-50% bitumen to 75-50% oil. Paper is best impregnated with a mixture at 100° in the Müller machine at a rate of 63 m./min. with the drying rolls heated with steam at 2.5 atm. pressure. About 35-40% of the mixture of the weight of sized paper is consumed in the process of impregnation. Of the papers used, the best practical results were obtained with the impregnation of bag paper of 80 g./sq. m. with the air-permeability not exceeding 150 sq. cm. Various procedures for impregnation and fireproofing of papers are described.

147. Grabovskii, V. A., and Yakimanskii, V. V. Making paper bags impervious to water and air by treating the pulp with emulsions of bitumens and paraffin. Tzentral. Nauch.-Issledovatel. Inst. Bumazh. Prom. Materialui no. 3/4:90-124(1935); C.A. 30:7340.

In the laboratory experiments, the best results in the production and use of stable concentrated emulsions of bitumens and paraffin were obtained by the use of from 5 to 10% of commercial stearin (mixtures of stearic and palmitic acids) as an emulsifying agent. Use of these emulsions somewhat decreased the mechanical properties of the resulting paper, but considerably increased its impermeability to water. The imperviousness to air is lower than that of papers directly treated with bitumen emulsions stabilized with mineral oils (lubricating oil). No particular advantages in the quality of paper were noted in treating pulp for impermeability as compared with a similar treatment of finished paper. In the commercial-scale experiments the best results in the preparation and use of emulsions were obtained with the aid of the Hurell homogenizer. The bitumen-kaolin emulsions gave somewhat inferior results, but may prove to be practical because of their lower cost. No particular difficulties in contamination of paper-making machines were observed.

148. Graebner, Winfred H., and Flom, Russell C. Packaging hygroscopic materials. U. S. patent 2,415,387(Feb. 4, 1947); B.I.P.C. 17:395.

The coating or barrier layer consists of 3% aluminum stearate, 5% ester gum, and 92% microcrystalline wax (melting at 145-147°F.). A typical laminated product consists of 30-pound kraft paper (24x36--480) to which are applied, as successive layers, 16 pounds of microcrystalline wax, a 24-pound plasticized glassine paper, and 16 pounds of the above coating. In place of the glassine, a regenerated cellulose may be employed. The laminated product may be formed into bags, containers, tubes, and the like, the seams being heat sealed.

149. Grant, Herbert A. Paper bags suitable for lime, fertilizers, etc. U. S. patent 1,860,244(May 24, 1932); C.A. 26:3922.

Multi-ply bags suitable for excluding air and moisture have one ply formed of a paper base such as parchmented kraft paper coated with wax and printing ink.

150. Greaseproof parchment bag for pie mix. Modern Packaging 22, no. 8:167(April, 1949); B.I.P.C. 19:643; Packaging Abstr. 6:485.

A vegetable parchment is now being used for packaging pie mix to replace the nongreaseproof paper bags formerly used which became brittle along the folds as the oil and grease were absorbed. The vegetable parchment is sufficiently plastic to remain strong at the folds of the bag, thereby giving added protection from shock. Since the bags are coated across the top with a thermoplastic adhesive, they can be sealed on equipment previously used. An outer carton is also employed.

151. Guide, C., de. Treating bags for holding and conveying chemical manure. British patent 19,473(Aug. 19, 1910); C.A. 5:2890.

Treating bags for holding and conveying chemical manure and the like, by dipping the bags into a solution of soap in water, removing them from the solution and suitably drying them for the purpose of impregnating and coating the fibers of the bags with insulating fatty soap serving to protect them from the action of acids, superphosphate of lime, and other liquid, solid, and gaseous corrosive substances.

152. Guillotte, J. E., and MacDermott, C. P. The Perkins-Southwick bond tester for measuring adhesion of polyethylene to paper. Tappi 40, no. 10:206-9A(Oct., 1957); Modern Packaging 30, no. 4:157-60, 211(Dec., 1956); B.I.P.C. 28:514.

The Perkins-Southwick bond tester was evaluated as a quantitative measure of adhesion of polyethylene to papers. It is concluded that the tester is sufficiently precise and accurate to determine various levels of adhesion, from bonds sufficient for handling purposes only to bonds as strong as the coated paper itself. The test can be used on porous as well as nonporous papers.

153. Haegermann, G. I. Testing and evaluation of sack paper. II. Testing of paper sacks. Zement 21:589-91(1932); C.A. 27:189.

Paper for cement sacks was tested and evaluated. The specifications of the German Cement Federation for testing paper sacks formulated in 1926, are given. The methods and results of the tests and the conclusions drawn are given.

154. Halls, E. E. Plastic sheet and film materials for "protection" and general wrapping. Plastics (London) 5:257-260(1942); 6:9-13, 62-4(1942); C.A. 36:4222.

Moisture permeability of wrapping materials is listed in three categories; papers and treated papers, regenerated cellulose sheet materials and cellulose ester films. The most moistureproof materials in each category were, respectively, a bituminized paper, a moistureproofed regenerated cellulose film, and a photographic cellulose nitrate film. Tables and graphs for wrapping materials based on rubber, and for a cellulose acetate membrane protected with coatings of various organic finishes are given. The article proceeds to some theoretical considerations on moisture permeability, and deals finally with the other properties necessary in wrapping materials.

155. Hanaya, Morimasa. Studies on the strength of sack paper and the influence of manufacturing conditions. I. Sack strength and bursting strength. J. Japan. Tech. Assoc. Pulp Paper Ind. 11, no. 4:261-5(April, 1957); B.I.P.C. 27:1279; Packaging Abstr. 14:1008.

Correlations among the burst, tear, and tensile strengths, drop number, and product of tensile strength and elongation of paper bags were studied. The drop number was calculated as a direct function of ply number and surface area and an inverse function of drop height and weight of bag contents. Drop number was not significantly related to burst strength but showed a significant correlation with tearing strength, impact strength, product of tensile strength and elongation, and moisture content (maximum drop number at 12-14% moisture content). There was also a significant correlation between bursting strength and the ratio of machine- and cross-directional tensile strengths for papers of the same basis weight within a certain tensile-strength range.

156. Hanousek, J. Gas permeability of packaging materials. 2. Obaly 3, no. 1:13-18(1957); Packaging Abstr. 14:548.

The article deals with the products which require either protection against the influence of gases or the so-called 'breathing' packaging. The possibility of mathematical design of suitable packaging materials and various types of packaging are considered. To achieve this, it is necessary to know the properties of goods to be packed. Further, the author shows various methods to express the gas permeability found in world literature, its calculation and conversion factors. Data concerning the permeability of packaging materials found in the literature are shown in tables with regard to the influence of temperature, relative humidity, plasticizers used, etc.

157. Hanousek, J. Permeability of packaging materials to gases. Obaly 2, no. 5:139-42(1956); Packaging Abstr. 14:364.

The importance of the permeability of packaging materials to gases is emphasized, especially in the protective packaging of food and other products and in breathing packaging. The author deals with gas-packaging and with vacuum-packaging in application of the plastic and other prepared materials. The mechanism of the penetration of gases in porous material and in plastic film is explained.

158. Hanousek, J., and Herynk, L. Permeability of packing materials to gases. 3. The interferometric method of ascertaining carbon dioxide permeability. Obaly 3, no. 2:38-41(1957); Packaging Abstr. 14:750; B.I.P.C. 28:1407.

For ascertaining the carbon dioxide permeability of various packing films, a new method has been worked out using a laboratory interferometer. This speedy and exact method can be applied under any partial pressures, temperature and relative humidity. Testing is carried out under pressures identical for both sides of the tested sample. For calculating the permeability P, formulae have been evolved that are applicable for the interferometric ascertaining of permeability of any gas and in apparatus of various sizes and pressures. For testing other gases that have to be taken into account in packaging technique, such as oxygen, nitrogen, sulfur dioxide, ammonia, hydrogen sulfide, etc., it is necessary to calibrate the interferometer appropriately. The permeability values of some packaging materials are given.

159. Hansen, O., and Scheuermann, H. Paper and its production. Canadian patent 464,015(March 28, 1950); U. S. patent 2,337,887(Dec. 28, 1943); B.I.P.C. 20:622; Packaging Abstr. 7:543.

After leaving the paper machine, a finished paper web is passed through a 2% aqueous solution of the sodium salt of a wood ether, and then through a solution of an aluminum oxide sol; the concentration of the second solution is adjusted so that the wood ether is converted to its aluminum salt. The resultant paper has a high folding endurance and wet strength; it is suitable for the manufacture of waterproof bags.

160. Hardenburg, R. E. Ventilation of produce. Modern Packaging 28, no. 7:140-4, 199-200(March, 1955); B.I.P.C. 25:636.

Packaging tests to determine the degree of ventilation necessary for film bags used to prepackage onions and to compare types and numbers of perforations for maintaining quality during marketing are reported. The 11 different types of polyethylene and Pliofilm bags, including one wet-strength kraft window bag, were provided with 8, 16, and 32 1/8- or 1/4-inch perforations or a number of 1/16- or 1/8-inch flaps, and four of each type were examined after three different storage periods—7 days at 75°F. (R.H. 45-55%) (I), 14 days at 75° (II), and 10 days at 40° (R.H. 80-85%) plus 7 days at 75°. It was concluded that onions kept in good to fair condition in the kraft bags under (I) and (II) conditions, although weight losses were slightly higher than in the film bags. Film bags should be perforated with at least 16 1/4-inch holes and 32 appears to be preferable; 64 1/8-inch holes should also be satisfactory. The flap-type perforations were inferior to the die-cut circular ones.

161. Heilman, William, Tammela, Viljo, Meyer, J. A., Stannett, Vivian, and Szwarc, Michael. Permeability of polymer films to hydrogen sulfide gas. Ind. Eng. Chem. 48, no. 4:821-4(April, 1956); B.I.P.C. 26:752.

The permeability of plastic films to hydrogen sulfide is of interest in several specialized packaging applications and because the gas is an analog of water vapor. Permeabilities of a number of polymeric films have been investigated over a wide range of pressures and temperatures, including polyamide (trade name, Nylon 6), unplasticized cellulose acetate, cellulose acetate plasticized with 15% dibutyl phthalate, rubber hydrochloride (Pliofilm NO), regenerated cellulose, polyvinyl butyral, polyvinyl trifluoroacetate, polyethylene, polyterephthalic ester (Mylar A), polyvinylidine chloride (saran 517), and plasticized ethylcellulose (Ethocel 610). The diffusion constants were determined from the approach to the steady state, and in some cases the solubility coefficients were determined by sorption technique, using a helix microbalance. The experimental procedure is described in detail. The results are discussed and interpreted from the point of view of the structure of the polymer films and will assist in the designing of suitable packaging and vapor-barrier materials.

162. Heiss, Rudolf. Studies on the packaging of roasted coffee beans. Verpackungs Rundschau no. 2:1-6(insert between p. 76-7)(Feb., 1955); B.I.P.C. 25:636.

Storage and staling experiments with roasted coffee beans packaged in different types and combinations of laminated bags did not give very definite results about the specific suitability or unsuitability of certain packaging materials. A few general basic recommendations are that packaging materials, adhesives, and liners should be as odorless as possible and the entire package (not only certain components of it) be highly water-vaporproof. A slight paper odor does not seem to impair the flavor of the hot extract. Unless the contents are consumed within a few days, the package must be hermetically resealable; otherwise staling becomes noticeable in a kitchen atmosphere under typical German humidity conditions within 9-10 days. Aluminum foil laminated to a liner which adsorbs and absorbs little oil will deter staling to some extent. The ideal package seems to be an oxygen- and carbonic acidproof construction (flat bags are therefore preferable to bottom bags) which is evacuated immediately after filling. Package constructions which are only slightly gasproof are not suitable for gas storage in a nitrogen atmosphere. The influence of light could not always be considered harmful; however it involves an uncertain factor. Aroma deterioration was found to vary greatly with different brands of coffee. Because of the limited number of experiments, the present results should only be considered of an orienting nature.

163. Hendel, Carl E., and Burr, Horace K. In-package desiccation. Modern Packaging 28, no. 5:121-4, 179-80(Jan., 1955); B.I.P.C. 25:447.

In-package desiccation, in which a product is wrapped together with a small package of drying agent and moisture is slowly transferred from the product to the desiccant during storage, allows dehydrated foods to be dried to substantially lower moisture levels, without heat damage, than is commercially feasible by other methods. A survey of earlier and recent literature on the subject summarizes the protection obtainable for various products by in-product desiccation, choice of desiccant, choice of desiccant container, and rate of desiccation. Because of its exceptionally high moisture-absorptive capacity at low R.H., active calcium oxide is considered the preferred desiccant for dehydrated fruit and vegetable products. The desiccant container must be permeable to water vapor, siftproof, sufficiently strong to resist abrasion, and must permit expansion of calcium oxide; jean cloth bags with separate kraft liners, partly filled rigid paperboard containers, and heat-sealing, stretchable bag materials are satisfactory if properly selected. The package atmosphere can offer a very large resistance to moisture transfer and hence greatly retard desiccation. 41 references.

164. Henderson, R., and Wallace, G. A. A simple apparatus for determining gas permeability of flexible films. Food Technol. 10, no. 12:636-8 (Dec., 1956); B.I.P.C. 27:431; Packaging Abstr. 14:196.

A simple inexpensive apparatus for determining the gas permeability of flexible packaging films has been designed. Although the principle is not new and makes use of a previously described manometer system, the cell portion of the instrument is new. It consists of a modified bacteriological pressure filter and represents a simplification over other cell designs. The apparatus approximates the conditions of vacuum packaging and yields results rapidly with a reproducibility factor of ± 10%. Although this is insufficient for accurate research studies on the theory of gas permeability, it is sufficient for rating the relative permeabilities of flexible films. Data are given to show the confidence limits of the method for both highly permeable and little permeable films. The permeability ratios found for saran, Mylar, and polyethylene films agreed with those reported by other investigators.

165. Herrmann, P. K. Suitability of paper sacks for storage and transport of milling products. Die Mühle 77:393(1940); Index Lit. Food Investigation 16, no. 4:309(March, 1945); Packaging Abstr. 5:531.

The suitability of paper sacks for the storage and transport of milling products was investigated. The methods of manufacture and testing of paper sacks are outlined. Comparative storage experiments over a period of a year showed that similar changes took place in air-tight paper and in jute sacks. Prerequisite for the use of paper sacks is that filled weight should be limited to 50 kg.

166. Herzberg, W. Behavior of bag paper at 80°. Wochbl. Papierfabrik. 54:2059-60(1923); Paper 32, no. 23:11, 21(1923); C.A. 17:3917.

The results are tabulated of several tests on paper bags used for holding cement at temperatures between 60 and 80°C. After drying for 5 hrs. at 80°C. the paper contained only 15% of its original moisture, the tearing strength was greater, the % stretch smaller, and the folding endurance decreased to about 1% of the original. A subsequent 24-hr. seasoning, at 65% humidity, brought all the values close to normal. The few tests demonstrated that paper heated to 80° b comes brittle and until it has absorbed sufficient moisture it is sensitive to mechanical treatment.

167. Herzberg, W. Effect of heat on the strength properties of bag paper. Wochbl. Papierfabrik. 56:1417-20(1925); C.A. 20:503; 24:3645; Tech.-Wiss. Teil, Papierfabr. 23:748-50(1925); Mitt. Materialprüfungsamt Sonderheft 6:4-6(1929).

The results of a large number of tests on the effect of heat on bag papers used for holding cement, etc., are summarized as follows: (1) compared with the paper sheets under ordinary conditions, paper made from soda pulp yielded a 22% and an all sulfite paper a 11% higher tearing length after a 24-hr. exposure to 80°C. and immediate testing; (2) similarly, the % stretch was reduced to 51 with the soda paper and to 63 with the sulfite sheet; (3) the folding endurance was decreased to 15% with the soda and to 2% with the sulfite and (4) the bursting strength was 7% less with both papers. It was shown that cement bags made from soda pulp are preferable.

168. Herzberg, W. Strength properties of sack paper. Mitt. Materialprufungsamt 37:19-26(1919); C.A. 14:2417.

Tests of 100 sack papers are given, with the purpose of establishing a normal standard for this paper, temporarily suggested as: weight per quarter m. 70-80 g.; mean of longitudinal and transverse tensile strength, 4000 m.; Schopper test (folding resistance), 250.

169. Hibbert, Ernest. Compound sheet material. Australian patent 9851/32(Sept. 21, 1933); C.A. 28:1533.

Alternate layers of paper and rubber latex are vulcanized together to produce a material suitable for wallpaper, floor coverings, electrical insulators, cement bags, etc.

170. Hilton, B. Moisture vapor transfer study results in new theory. Package Eng. 2, no. 2:28-30, 32-4(Feb., 1957); Packaging Abstr. 14:365.

Making use of accepted theories of physical chemistry, the article shows how experimental work on polyethylene and 300 gage cellulose film is proving theories advanced by H. Corte and W. Schoch (Abstr. no. 94) to be correct. They claim the driving force for moisture vapor transfer to be the difference in the layer of moisture vapor condensed upon the two surfaces of the barrier material, that is, the side adjacent to the humid atmosphere will have a higher concentration of moisture vapor upon the surface than will the opposite side that is adjacent to the arid atmosphere.

171. Hoffmann Jacobsen, P. M. Rheology of paper. World's Paper Trade Rev. 134, no. 3:150, 152, 155-6(July 20, 1950); B.I.P.C. 21:112.

Remarks on the applications of rheology of paper, stimulated by a recent article by Rance, to the Schopper folding endurance test and to the drop test for bags are given. With regard to the former, data are given for paper which appear as linear relationships when tensile loads are plotted as ordinates (linear scale), and time to failure, or number of cycles, are plotted as abscissas (logarithmic scale). Three relationships are given: (1) tensile load, expressed as a percentage of the ultimate (short-time) strength, vs. time to failure; (2) maximum loads in schedules of cyclic changes in tensile force, intended to simulate the variable loading in the Schopper folding endurance test, vs. the number of cycles to failure of the paper; and (3) loading in the Schopper folding endurance tester, expressed as a percentage of the tensile strength (variations effected by varying the widths of the specimens) vs. the number of folds. The data are not fully discussed; although they appear to show the usual strong dependence of the number of double folds on the tensile loading, the author states that "the tension is of rather little influence on the fold." (The abstractor wonders whether it was not the intention of the author to state that the mechanical action of folding is of primary importance, in contrast with failure resulting merely from cycling in tensile load.) Remarks are made on a drop-testing schedule, and theories are given for the drop test and for the pressure produced in bags as a result of stacking in a pile.

172. Holter, Alfred. Impregnating paper for bag manufacture, etc. U. S. patent 1,714,222(May 21, 1929); C.A. 23:3575.

Paper is prepared for subsequent folding and forming by impregnating one surface of a paper web with an aqueous solution of a material such as soap and glue which can react with soluble aluminum compounds to form insoluble reaction products, and impregnating a second web with a solution containing alum or other soluble aluminum compound, and then bringing the two surfaces into contact with each other immediately prior to folding or otherwise fabricating into webs (without drying prior to folding).

173. Holwech, W. Measuring the diffusion of water vapor through paper. Papir-J. 20, no. 21:233-4(Dec. 15, 1932); B.I.P.C. 3:144.

An apparatus is described for measuring the diffusion of water vapor through paper. The instrument is used for determining the suitability of paper bags for wrapping hygroscopic goods.

174. Hoogstraten, C. W. van. The possible cause of fire in Chile saltpeter, packed in jute bags. Chem. Weekblad 43:185-9(1947); C.A. 41: 3629.

Experiments were carried out with a hollow aluminum block as used by Kreulen to determine the ignition temperature of used jute bags with adhering commercial sodium nitrate. In most cases, on heating, a reaction set in at temperatures between 160° and 170°. The ignition temperature was around 220°, while the combustion temperature was 240° or higher. In some cases reaction temperatures of about 130° were noted and combustion took place as soon as the low reaction temperatures were recorded. It was found that these abnormal samples contained in addition to small amounts of iodate (0.1%) and perchlorate (0.55%) appreciable amounts (up to 16%) of magnesium chloride. Since this salt in saturated solution of sodium nitrate forms $Mg(NO_3)_2 \cdot 6H_2O$, which hydrolyzes above its melting point (90°) with formation of nitric acid, it is likely that under special circumstances of abnormal temperature and friction spontaneous combustion may occur. It is suggested that jute bags be replaced by containers of "duckraft" paper.

175. Houston, Paul L. A new test for lime and cement bag paper. Paper Trade J. 71, no. 11:34-6(1920); Tech. Assoc. Papers 3, no. 1:7-11(1920); Nat. Bureau Standards Tech. Paper No. 187, 1921. 19 p.; C.A. 14:3319; 15:1397, 3745.

The quality of bag papers can best be determined by a Schopper tensile strength machine modified to give the resiliency of the paper.

176. Howard Plastics Inc. develop shock-impact test. Pre-Pack-Age 7, no. 9:22(May, 1954); Packaging Abstr. 11:760.

A total-area shock can be produced in a polyethylene bag by filling it with a calibrated weight and dropping it a certain metered distance.

177. Hu, K. H., and Nelson, A. I. Testing film bags for leaks. Modern Packaging 26, no. 12:124-5, 177(Aug., 1953); Packaging Abstr. 10:801.

Controlled air pressure in bags immersed in water locates and evaluates weaknesses, and can establish the existence of pinholes. The pressure is limited to 8 in. of mercury. A diagram of the apparatus used is given.

178. Hu, Y. Packaging sugar in kraft bags. Rept. Taiwan Sugar Expt. Sta. (Taiwan) no. 7:175-87(1951); Brit. Abstr. BIII, 1952:282; Packaging Abstr. 9:708.

Kraft paper bags, made in Taiwan, resisted damage in transport, bursting under pressure, and atmospheric moisture, but not liquid water. The use of waterproof glue on the seams may overcome the last defect.

179. Hydroloid, Ltd. Paper vessels and containers. British patent 201, 463(Oct. 25, 1922); C.A. 18:470.

Vessels and containers, such as paper bags, are formed of paper which is either previously or subsequently treated with sizing material such as animal size, casein or albumin, then passed between pressure rollers either in the sizing material or subsequently, and is also treated with alum, chrome salts, formalin, etc., to harden the size and render it insoluble in water, the hardening material being mixed with the sizing material or used after the sizing. Acids, such as lactic acid, or alkalies, such as sodium hydroxide, may be added to the size. The paper may be allowed to stand in a wet state both before and after hardening, and may be cooled by a current of cold air prior to drying on skeleton drums by warm air. Glycerol or an easily emulsifiable material such as soap or castor oil may be employed to toughen the treated paper, and a coat of transparent varnish may be applied to impart flexibility to the paper.

180. I. G. Farbenindustrie A.-G. Rotproof material. German patent 618,785(Sept. 18, 1935); C.A. 30:1248.

Cellulose material for sacks, fishing nets, sails, tents, etc., is made rotproof by treatment with mono- or poly-azo dyes containing at least two nitrogen dioxide groups in the molecule; the material is also fast to light and water. Thus, fishing nets are impregnated with 2,3-hydroxynaphthoyl - 4 - amino - 2",4" - dinitrodiphenylamine and treated with diazotized 2-nitro-4-chloroaniline to render them rotproof. Other examples are given.

181. Inclined plane method for the determination of the coefficient of friction of plastic sheets and films. Rev. de Plasticos 7, no. 39:143-7 (1956); Brit. Plastics Federation Abstr. 11, no. 12:955(Dec., 1956); Packaging Abstr. 14:107.

A method is given for determining the coefficient of friction of sheet and film materials. Diagrams and illustrations of the apparatus used are given.

182. Institut für Lebensmitteltechnologie. Physical properties of packaging materials at various relative humidities. Das Papier 1, no. 9/10: 167-73(Nov., 1947); B.I.P.C. 18:614.

The following materials were tested at 20°C., using relative humidities (R.H.) ranging from 37% to 90%: a sized soda bag paper (I), a sized sulfite bag paper (II), "Zellbast I A 11," unsized (Zellstoff-Waldhof) (III), an unsized calendered paper without groundwood pulp (IV), an imitation parchment (Zellstoff-Waldhof) (V), a glassine (Zellstoff-Waldhof) (VI), a genuine vegetable parchment (VII), cellophane (VIII), a laminated bag liner paper prepared from two layers of glassine paper (IX), "Zewaphan" (a lacquered glassine) (X), and Igelit (a polyvinyl chloride film) (XI). At 37% R.H., the moisture contents varied from 10.4% for VIII down to 0.17% for XI. Full data are given for the following: weight/unit area, breaking length, elongation, folding endurance, burst, and percentage of variations of the strength values taken at 65% R.H. from those at other R.H.'s. (XI) was unique in that it showed very slight changes in strength up to about 75% R.H. Most of the strength properties, other than folding endurance, decreased with increasing R.H. Elongation also increased with R.H. Causes for such changes are discussed. Maximum strength values for the various materials were found at the following % R.H., the order being breaking length in the machine (MD) and cross-machine (CMD) directions, elongation in (MD) and (CMD), burst, and folding endurance in (MD) and (CMD): (I), 37, 37, 90, 90, 37, 90, 75; (II), 37-53, 37, 90, 90, 53, 90, 75; (III), 53, 37, 82(?), 90, 37-43, 75, 75; (IV), 53, 53, 90, 90, 43, 90, 82; (V), 37, 37-43, 90, 90, 43-53, 82, 75; (VI), 37, 37, 90, 90, 43, 75, 75; (VII), 37, 37, 90, 90, 37-53, 90, 90; (VIII), 37, 37, 90, 90, 37, --, --; (IX), 37-43, 37, 90, 90, 37-43, 82, 75(?); and (X), 37, 37, 90, 90, 43, 75, 82. In the case of (XI), the moisture content of which never exceeded 0.88% even at 90% R.H., changes at different R.H.'s were very slight, the maximum change from 65% R.H. being a drop of 27% in breaking length (MD) at 90% R.H. Ordinarily, folding endurance was highest in the (MD). However, (VII) showed a much greater folding endurance in the (CMD). The study shows very clearly that, in choosing packaging materials for their various strength characteristics, it is essential to test them at the R.H. range in which they will find their greatest use. Ideal conditions would entail the use of purified pulps, papers from which maintain their strength properties over a very wide range of R.H. The present results are in good accord with those found by Houston, Carson, and Kirkwood.

183. Ioffe, G. Paper for special paper-bag containers. Tzentral. Nauch.-Issledovatel. Inst. Bumazh. Prom. Materialui no. 1:139-51(1935); C.A. 30:3231.

The problem of suitable and inexpensive containers for the transportation and storage of various materials, particularly fertilizers and sodium chloride, is discussed.

184. Itterbeek, A. van, Verhaegen, L., and Paemel, O. van. Tests on the diffusion of water vapour through sheets of viscose film and polyethylene. Bull. Inst. International Froid, Suppl. 1953-1:203-13; Packaging Abstr. 11:229.

Small viscose film and polyethylene envelopes containing silica gel were suspended in a commercial refrigerator and removed periodically for weighing. The method was later abandoned as unsatisfactory for determining the coefficient of diffusion of frozen food packaging materials. A second method was developed in which frozen foods in their normal packings and also some viscose film and polyethylene envelopes containing wet sponges were suspended in a closed refrigerator. The packages and envelopes were weighed inside the refrigerator without removing the cover. The relative humidity in the refrigerator was kept very low, and the diffusion constant was obtained from the decrease in weight of the packages with time. The effect of ventilation inside the refrigerator was also studied. Details of the apparatus, method and results are given.

185. Iversen, C. The standardization of (block bottom) bags for food products. Allgem. Papier-Rundschau no. 17:725-7(Sept. 3, 1953); Packaging Abstr. 10:919.

Although bag sizes were standardized 15 years ago in Germany, the shortage of paper led to disuse of the standards. The case for further standardization is stated. Sizes will depend on quality, basis weight and end use.

186. Jacobson, J. E. Ammonium nitrate explosions at Texas City. Mech. Eng. 69, no. 12:1054-5(Dec., 1947); B.I.P.C. 18:324.

The author offers possible reasons for the explosions of ammonium nitrate at Texas City in an effort to aid the safe handling of this material. He refers to the air trapped in the bags made of five plies of paper, two layers of paper next to the chemical, then a layer of asphalt-treated paper for waterproofing and, finally, two more layers of paper. The bags can withstand considerable pressure from within exerted by the trapped air which, when the bags are piled, is compressed with a corresponding rise in temperature. At 390°F., the decomposition of ammonium nitrate to ammonia and nitric acid changes from endothermic (between 220 and 390°F.) to exothermic, furnishing nitrogen monoxide, steam, and its own heat. A rapid temperature rise would cause local decomposition until the whole mass exploded. Nitric acid reacts with paper to form explosive nitrates (nitrocellulose, pyroxylin, or guncotton). The Texas City case may have been caused by a reaction of the nitric acid and the two paper layers to form guncotton (without washing to remove all traces of the acid as is being done commercially as a precaution). Small spontaneous explosions at 240°F. could furnish the heat to change the reaction to an exothermic one and from then on the ammonium nitrate reaction would evolve its own heat until finally the entire mass would explode. A method of piling the bags in layers not over five feet high is suggested, with self-supporting steel structures between the individual layers.

187. Jarrett, D. Materials testing program vital to quality control. Paper Film and Foil Converter 30, no. 8:19-23(Aug., 1956); Packaging Abstr. 13:835.

The following quality control and research tests for foils, film and paper are recommended and outlined: pin hole, moisture content, solvent retention, weight, bond and curl, oil and grease resistance, stability and aging, flavor and odor, and gas transmission.

188. Jones, J. A. J. State laws pave way for single use flour bags. Food Industries 20, no. 3:364-5(March, 1948); B.I.P.C. 18:547.

During the past year, nine states enacted legislation to prohibit the re-use of bags for flour or to require that re-used bags be laundered, the latter an economically impractical process. The resultant shift to one-way bags has focussed attention on multiwall kraft and cotton sheeting bags. Reports on comparative tests indicate that the kraft bags are definitely superior in sanitation, less loss through sifting and flour left in the supposedly empty bag, and facilitation of clean workshops. However, where the labor force has not been accustomed to using the kraft bags, their slippery exteriors make them more difficult to handle. During 1947, 52 million four-ply bags were purchased by the milling industry for shipping flour; the 1948 estimate is 108 million. A survey of loading, shipping, and unloading of freight cars revealed that adequate "set back" prevents damage from creeping and longitudinal shift; flat or gusset loading of the car doorway is important; less damage to the bags occurs when the sewed ends are placed to the wall; and a tightly packed end load will hold firm and is less likely to shift. Proper preparation of the freight car includes the removal of nails, all dirt, and debris; it should be free of moisture and lined with a properly applied heavy carlining paper.

189. Jullander, I. Treatment of paper with silicon esters. Nature 162, no. 4112:300-1(Aug. 21, 1948); B.I.P.C. 19:126; Packaging Abstr. 6:54.

Ordinary filter paper exposed to the vapors of a polymer silicon ethyl ester for 16 hours at 120°C. was completely impermeable to water for 11 hours. Immersion in the liquid ester for 4 to 66 hours produced a paper with regularly increasing water impermeability, improving from 1 to 50 hours. Unsized kraft gave similar results; experiments with sized paper were unsuccessful. The wet strength of treated unsized kraft was three to seven times that of untreated paper. It is also possible to carry out the treatment so that no water repellency is observed, but the wet strength is increased considerably. With treated filter papers, it is possible to filter 10 to 45% sodium hydroxide solution. The water-repelling effect is probably similar to that observed when paper is treated with silicones; the increase in wet strength is thought to be caused by cross links of silicon atoms formed between the cellulose chains.

190. Kadoya, T. Study on the strength of small paper bags. J. Japan. Tech. Assoc. Pulp Paper Ind. 11, no. 4:249-56, 269(April, 1957); B.I.P.C. 27:1279; Packaging Abstr. 14:1043.

The strength properties of paper bags made of kraft paper and of bleached wrapping paper were investigated, using a Japanese standard and a special drop test. Notch-type and wedge-type paper strengths and folding endurance showed good correlation with the results of drop tests. Using kraft bags, the results of a rotating drum test showed less fluctuation than did those obtained in a manual and a machine drop test.

191. Kaestner, Paul T. Web flatness indicator. U. S. patent 2,809,519 (Oct. 15, 1957); B.I.P.C. 28:718.

The apparatus claimed continuously determines and indicates the flatness (I) of webs of paper, cellophane, and the like during their manufacture or use, (I) being the tendency of the web to sag more in some longitudinal lanes than in others when suspended across two parallel transverse supports.

192. Kahn, Kenneth D. New desiccant keeps quality in, moisture out. Food Industries 20, no. 1:18-19, 156, 158(Jan., 1948); B.I.P.C. 18:397.

Protection against moisture vapor can be obtained for foods and pharmaceuticals by introducing a nonlime base material, called Desiccite, in a leakproof container, into the product package. Desiccite is prepared from montmorillonite, a naturally occurring hydrous aluminum silicate. It is inert, tasteless, odorless, nontoxic, nonabrasive, and neutral, absorbs moisture by physical means alone, and will not liquefy or soften. It is sold for consumer-size food packages in packets of heavy weight tea-bag paper, which are placed in the food containers when they are filled. This addition costs about a quarter of a cent per package. The cost of a bag of desiccant is about one cent. Larger amounts of the product are packaged in paper-lined bleached jean cloth or paper-backed cloth bags. When the desiccant is placed in cases containing a number of individual cartons of food, some sort of moisture barrier must be used, such as asphalt-laminated kraft, paraffined wrappings, or metal foil-kraft laminates.

193. Karel, M., Aikawa, Y., and Proctor, B. E. WVP by electric hygrometer. Modern Packaging 28, no. 8:213-15, 322, 324(April, 1955); B.I.P.C. 25:742; Packaging Abstr. 12:529.

Studies of the electric hygrometer, of a modification of the apparatus developed in the Department of Food Technology at the Massachusetts Institute of Technology, and of the applicability of the apparatus to the investigation of typical research problems in food packaging are reported. The studies were made of the water-vapor permeability of Mylar polyester film under various conditions of vapor-pressure differential, temperature, and film thickness and also on saran film after storage at different temperatures and humidities. A suitable permeability cell was constructed which consists of two chambers made of chrome-plated brass and attached by a unique hinge arrangement. The specimen is placed between the two chambers of the cell, and the permeability is calculated on the basis of the rate of change in the R.H. of the upper chamber. The test procedure and calculations are outlined. The test results confirmed that permeability through saran film was directly proportional to the vapor-pressure differential, that permeability through Mylar film was inversely proportional to the film thickness, and that in the temperature range investigated, there were no direct effects of temperature on Mylar film but marked effects on saran.

194. Karl, Frank G.m.b.H., Weinheim-Birkenau, Germany. Testing instruments for plastics. Neue Verpakkung 8, no. 3:103-5(March, 1955); B.I.P.C. 25:821.

Several recently developed instruments of particular interest to the packaging industry are described, including a strength tester for plastic foils; a hardness tester for paper, board, foils, leather, and rubber; the Elmendorf tear tester; a water-vapor permeability tester; a bending stiffness tester; a low-temperature resistance tester; a compression tester for shipping containers; and a compression and stiffness tester for papers, boards, plastics, and similar materials to be used at relatively low pressures.

195. Kato, H., and Otomo, M. Study of treated papers and their uses: tests of manufacture, with these papers, of sacks for fertilizers, and practical tests on these sacks. J. Japan Tech. Assoc. Pulp Paper Ind. 9, no. 7:284-6(July, 1955); Assoc. Tech. Ind. Paper Feuill, Bibl. no. 10:14 (Oct., 1955); Packaging Abstr. 13:4.

Multiwall bags for fertilizer were made of one ply of sodium carboxymethylated 62 lb. kraft paper and one ply of asphalted paper. Train transport tests showed no damage to the bags.

196. Kazarinov, G. G. Paste glue for laminated kraft-paper bags. Bumazh. Prom. 16, no. 1:45-9(1938); C.A. 33:5542.

In packing of hot cement (45-50°) into bags glued with dextrin the latter softens and on cooling crystallizes with the resulting rupture of the glued folds. Cornstarch glue gives satisfactory results.

197. Kershaw, A. Non-woven textile fabrics. Textile Mfr. 75:559-60 (Dec., 1949); Bull. Brit. Jute Trade Assoc. 2, no. 8:A7(Jan., 1950); Packaging Abstr. 7:320.

Characteristics and applications of nonwoven fabrics are outlined and discussed. Nonwoven fabric differs from woven fabric in that the bond between the individual fibers is a mechanical one, as distinct from that resulting from the usual textile processes. Nonwoven fabrics are not necessarily felts, and indeed many of the fibers utilized are nonfelting. As a packaging material, the smooth dust-tight construction of nonwoven fabric made up into sacks or bags by use of a suitable adhesive is said to offer many advantages over cotton or hessian bags. As experience in the bonding of the wide variety of fibers now available increases, it is possible that the new industry may become important in a nation's war economy, as many "waste" and home-produceu fibers can be utilized for the production of nonwoven fabrics, without the necessity for spinning and weaving.

198. Kish, Aladar F. Films for pre-packaged poultry. Modern Packaging 26, no. 11:130-4, 193(July, 1953); B.I.P.C. 25:909.

Preliminary studies on prepackaged poultry wrapped in flexible films are reported. The conclusions reached as a result of these investigations include: Prepackaged, fresh-killed, eviscerated poultry should be kept no longer than 48 hours at 34-38°F. in a self-service, open-top refrigerator. The over-all performance of the four films tested (300 LSAT cellophane, 100 saran 517, 100 polyethylene film, and 120 Pliofilm HM) was essentially the same through the 48 hours of the package period; the test results indicate also that it is better to perforate the packages after wrapping. Severe dehydration occurring within 24 hours with the unwrapped poultry indicates the need for a protective wrapper. There were no slime or off-color developments with any of the films in 48 hours; carcass color changes were slightly greater in LSAT film after 72 hours, but the presence of off-odors and slime development was not as great as with other test films. LSAT cellophane was superior to all films tested in minimizing package condensation, in package appearance and brilliance, and in ease of handling during the packaging operation.

199. Klingelhöffer, H. A new tension and stretch recorder for packaging films and cushioning materials. Inst. f. Lebensmitteltech. u. Verpackung, Munich, 1953. 4 p.

200. Konop, R., and Vyskočilová, K. Influence of temperature upon paper bags. Sborník výzkum. praci z oboru celulozy a papiru (Collection Czechoslov. Pulp and Paper Ind. Research Works) 1:279-97(1956); B.I.P.C. 27:1151; Packaging Abstr. 14:288, 842.

The effects of elevated temperatures on the strength properties of bag papers and of paper bags filled with hot cement were examined in the laboratory. Strength properties, especially tensile strength and folding endurance, are functions of the moisture content of paper. Temperatures of 60-80°C. accelerate the desiccation of paper but do not necessarily cause a permanent strength decrease, provided sufficient opportunity for moisture recovery is given. Sulfate pulp is more suited than sulfite pulp for cement-bag papers. Sulfate pulp loses moisture more slowly and usually recovers it faster. It is more elastic, having a more linear tensile-strength curve, so that paper made from kraft pulp will show greater shock and impact resistance.

201. Kortnäs Aktiebolag. On the quality and testing of sack paper. Gavle, Sweden. 13 p.; Packaging Abstr. 11:1038.

Until recently, sack paper tests have been mainly to obtain knowledge of the static stress to which the paper may be subjected. But dynamic stress tests also give valuable data. High stretch for sack paper means: increased breaking energy, tearing strength and softness; increased power of resistance to rapid dynamic stresses; and increased possibilities of deformation of filled sacks without rupture.

202. Kotte, Hans. Strength properties of bag papers. Allgem. Papier-Rundschau no. 20:864(Oct. 26, 1951); B.I.P.C. 22:270.

Reference is made to the statistical study of Anderson and the lack of correlation in the properties of handsheets and machine-made paper. An experimental paper machine (working width 22 cm.) is described which was constructed by the Papierfabrik GmbH. vorm. Brüder Kämmerer, Osnabrück and which was exhibited at the recent DRUPA show in Düsseldorf; the machine is recommended for laboratory work to obtain a better correlation between laboratory and mill data.

203. Křtinský, K. Flour storage in jute and paper sacks. Mühlenlab. 7:131-4(1937); C.A. 31:8718.

Data are tabulated and plotted to show the changes in moisture and gluten content and gluten quality of flour stored over a 3-month period in jute and in paper bags. At room temperature the changes incident to storage are similar for flours stored in these two types of containers, both of which are considered satisfactory.

204. Kühl, Hugo. The suitability of paper bags for the storage and transportation of flour. Kartonagen- Papierwaren-Ztg. 44, no. 24:188-9 (June 14, 1940); B.I.P.C. 11:415.

Paper bags have certain advantages over the exceedingly air-permeable jute bags for the storage and transportation of flour, such as less dusting, better protection against moisture and insects, greater cleanliness, no fibers becoming detached from the fabric and mixed with the flour, etc. The paper bags must have high strength properties and resistance to crushing. A prime requisite for successful storage of flour in paper bags is that the contents are never filled into the bags with a moisture content in excess of 14%. A drawback of paper bags is their tendency to split when being filled; bags with valves have improved this condition.

205. Kumler, Ralph W. Wet strength resin for stock addition. Paper Mill News 66, no. 25:62(June 19, 1943); B.I.P.C. 13:455.

The effects of acid melamine resin on paper stock are discussed, including improved wet strength, dry bursting and tensile strengths, and folding endurance; these effects are permanent under conditions of high temperature and humidity. Toxicity and dermatitis tests have shown that paper treated with this resin may be safely allowed to contact foodstuffs and the human skin. Melamine-treated papers are chiefly used for three purposes: for packaging moist materials or dry materials where the packages will be exposed to the elements, paper for printing which may be exposed to water, and papers which must not lint when moistened, such as paper towels and lens paper. Recent rough-handling tests on multiwall bags in wet condition indicate that the capacity of the bags to resist such handling is roughly proportional to the number of wet-strength plies included in the construction. Those having the highest wet strength treatment survived 100%.

206. Kundu, B. C. Jute--world's foremost bast fibre. II. Technology, marketing, production and utilization. Econ. Botany 10, no. 3:203-40(July-Sept., 1956); B.I.P.C. 27:524.

Jute fiber is the world's principal material for the manufacture of sacking and canvas, as well as for the production of upholstery, rugs, carpets, and roofing fabrics. Secondary products are food from its tender shoots, medicines from its dried leaves, fuel and paper from its stems, and oil from its seeds. 250 references.

207. Kunze, K. S. Measuring the heat-sealability of coated regenerated cellulose films. Kunststoffe 45:16-17(1955); J. Appl. Chem. (London) 5, no. 5:800(May, 1955); Packaging Abstr. 12:703.

A method for testing the heat-sealability of coated regenerated cellulose film is described which gives good reproducible results and which has been used in practice for many years. In this method, which is described in detail, the seal is made under constant pressure in an electrically heated apparatus in which the temperature can be regulated from 20 to 200° and kept constant. A temperature of 110° is usually the optimum for sealing. After conditioning in air, the test pieces are cut to strips of required size (15 mm. wide and 30 mm. long), the strips then cracked transversely across the center and then sealed approximately below the crack. The sealed strips are left for 72 hr. at 20° in air of R.H. 50% and then torn apart in a tearing test apparatus operating at a constant speed of 100 mm. per min. Ten tests are made to evaluate the strength of each sealing. The effect of the temperature of sealing on the strength of seal is discussed.

208. Kunze, K. S. The aroma permeability of cellulose films. Verpackungs Rundschau no. 9:471, 474-5(Sept., 1955); B.I.P.C. 26:383.

Cellulose films prepared by the viscose or cuprammonium process (I) as a rule consist of about 75% cellulose, 10% water, and 15% plasticizer (usually glycerol or glycols); they exhibit a low permeability for different aromas (II) and are therefore particularly suitable for the packaging of spices or similar odoriferous articles. The purpose of the present study was an investigation of the reasons for this low (II). In general, the (II) of (I) depends upon thickness and area of the film, type and quantity of plasticizer, behavior of lacquers and their components, temperature and time, and the behavior of the aromatic substance or its constituents with regard to its solubility in water, plasticizer, or lacquered layer. The results indicate that the insolubility of most aromas in the water present in (I) accounts for the latter's aromaproofness. Plasticizers with a low solubility for aromas, such as glycerol, should therefore be used. A weatherproof lacquering of (I) may be essential for improving water-vapor permeability and heat-sealing properties, but may influence (II) adversely, depending on the lacquer's constituents: some lacquers tend to become sticky. This danger can be minimized by employing two films, an inner nonlacquered and an outer lacquered one.

209. Kunze, K. S. The water-vapor permeability of regenerated cellulose. Neue Verpackung 8, no. 11:639-42(Nov., 1955); B.I.P.C. 26:721; Packaging Abstr. 13:94.

The permeation coefficient of plastic films indicates, as a general rule, the extent of water-vapor permeability (I) of such films. However, this rule does not hold for regenerated cellulose films (II) which are strongly dependent on their moisture content; this, in turn, varies with type and amount of plasticizer and the R.H. of the surrounding air. Lacquering of both sides of (II) will reduce (I) quite appreciably. With heat-sealable lacquered layers completely vaporproof seams may be obtained, provided the process is carried out under optimum conditions of pressure, temperature, and reaction period. The vaporproofness of the seams decreases when the films are exposed to air with a high moisture content. The significance of these factors in packaging problems with cellophane is discussed.

210. Kunze, K. S. The water vapour permeability of nitrocellulose films. Farbe u. Lack 62, no. 8:372-4(Aug., 1956); Packaging Abstr. 13:823.

It was found that the water-vapor permeability of these films depended on the type of solvent used in their production and on the nitrogen content of the cellulose. The addition of plasticizers and resins reduces water-vapor permeability. A moisture difference between the two sides of the film was also found to affect permeability.

211. Lahey, Richard W. Multiwall bags. Chem. Eng. 57, no. 3:201-5; no. 4:221-2, 224, 226(March, April, 1950); B.I.P.C. 20:590, 645.

Multiwall paper shipping bags, which are fabricated from the cheapest of packaging materials and have the advantages of a completely flexible container, are becoming increasingly useful in transporting chemicals. These bags consist of three to six plies of kraft paper of tubular form, each ply designed to provide a special type of protection, such as resistance to grease and oil penetration, abrasion, acids and alkalies, etc. The side seams are pasted, with waterproof glue if necessary, and bottoms are closed by pasting, sewing, or taping. Open-mouth sacks are closed after filling by sewing, taping, or wire or string tying, whereas valve bags are closed at the top and bottom by the manufacturer, leaving only a small opening in one corner, which is self-closing. Committee D10 of A.S.T.M. has developed an accelerated test, soon to be published as a tentative standard, for determining the required mechanical strength of a multiwall bag. The development of a process for coating polyethylene onto kraft bag paper has greatly increased the versatility of these bags.

212. Lahey, Richard W. Multiwall container. U. S. patent 2,432,968 (Dec. 16, 1947); B.I.P.C. 18:346.

A multiwall paper and/or fabric container has an inner portion which is provided with a dispensing spout. The outer portion can be made of kraft paper, fabric, or a combination of these, whereas the inner portion is made of crepe paper. The overlaps of the individual plies are staggered to increase the strength of the assembly and to prevent the passage of moisture directly through the seams or between the plies.

213. Lahey, Richard W. New multiwall paper bags protect products in outdoor storage. Chem. Eng. News 21, no. 18:1556, 1558, 1590(Sept. 25, 1943); B.I.P.C. 14:91.

Reference is made to a new type of multiwall paper bag developed jointly by the Bemis Bro. Bag Co., and the American Cyanamid and Chemical Corp. The bag protects its contents when stored outdoors and can withstand transportation and handling abuses when soaking wet. The bags differ from ordinary multiwall sacks in two important respects; flannel-lined cotton tape is used to replace the ordinary creped kraft tape at both the top and bottom closures and the paper is treated with melamine resin to provide high wet strength and resistance to scuffing when wet. Interesting shipping tests were made with bags of eight different types and filled with crystalline trisodium phosphate which is soluble in water and cakes readily on absorption of moisture. The tests are outlined in detail; each bag was judged on its ability to protect its contents from exposure, handling, dropping and transportation. The results are given in a table; the specifications of the five principal bags are appended. The performance of type "D" double multiwall bag rated highest.

214. Lahey, Richard W. Packaging. Chem. Eng. News 24:258(1946); C.A. 40:1360.

New federal specifications for paper shipping sacks are given.

215. Lahey, Richard W. Paper-lined textile bags for your products. Chem. & Met. Eng. 42, no. 12:662-6(Dec., 1935); B.I.P.C. 6:249.

The article describes different combinations of paper and textiles for heavy duty bags, the paper serving as liner and the textile bag as supporting element. A proper liner must be able to bend, flex and stretch in unison with the outer bag, so that the latter will absorb all shocks and strains, hence it must fit perfectly into the outer container. Extreme care must be used in the choice of size, insertion of liner into the bag, and the filling and closing of the package. Creped kraft paper (single stretch or double stretch type) treated with different coatings was found to give satisfactory service for loose paper liners. More recent developments include creped paper laminated to burlap and cotton using asphalt or rubber latex as adhesive.

216. Lahey, Richard W. Scutan asphalt-infused kraft paper bags and moisture-proof containers. Chem. Inds. 48, no. 6:740-1(June, 1941); B.I.P.C. 11:463.

Scutan is an asphalt-infused kraft paper, the infusion process consisting of the immersion of the preheated paper into the specially blended hot asphaltic bath, and passing the coated paper over water-cooled rolls for rapid restoration to normal temperature. Scutan-treated paper is claimed not to bleed at any atmospheric temperature and to stand subzero temperatures without cracking. It is available in either the single or double infused type and is used as a liner in many large and small duplex and multiwall bags. Other applications include its use in house building, in laying cement roads, in the walls of refrigerated railroad cars, and for providing moisture resistance for many types of containers.

217. Lahey, Richard W. Testing bags for strength. Chem. Eng. News 22, no. 14:1191-2(July 25, 1944); B.I.P.C. 15:62; Packaging Abstr. 2:81; C.A. 38:5082.

One of the more important considerations in selecting the proper bag construction for shipping is to decide how much strength is required for protection of the product against handling, transportation, and storage hazards. It would be of considerable help if there were some standard laboratory test which would provide accurate comparison of the ability of sacks to stand handling and transportation abuses, a number of which are outlined. The Quartermaster Corps developed a "cycle" test which consists of dropping a bag from a set height on each face, both ends, and both edges, first on a flat surface, then across a piece of timber. If the bags withstand successfully all of the drops in one cycle, the test is repeated, the height of the drops being increased by one foot increments, until failure occurs. All tests are made with drop test tables to eliminate the irregularities of hand dropping. The author suggests a modification of the procedure as a basis for developing a standard test, outlining all details, such as conditioning, filling, and individual phases. Emphasis is placed on the fact that the utility of the tests has not yet been proved over a wide variety of conditions. Before adopting it as a standard, experience with as many different constructions as possible must be accumulated.

218. Lane, Gardiner. Multiwall paper bags come of age. Chemurgic Dig. 1, no. 23:178-9(Dec. 15, 1942); B.I.P.C. 13:323.

Brief reference is made to the wide range of special multiwall bag types which have been developed as containers for a variety of chemical and other products. New moisture and chemical resistant kraft papers are employed in combinations specially designed to meet the needs of the product to be packaged.

219. Lange, Wilhelm. Demands on the nature and properties of papers for bags. Wochbl. Papierfabrik 69, no. 45:933(Nov. 5, 1938); B.I.P.C. 9:161.

Strength and good printing surfaces are the most essential properties of good bag papers; brittle paper is unsuitable. According to the specific use requirements waste paper, jute paper, kraft paper, unbleached and bleached sulfite paper, and greaseproof paper are used.

220. Lansing, K. H. New anti-rancid bags are coated with oat-plant flour. Paper Converters Envelope Ind. 11, no. 4:16(April, 1937); B.I.P.C. 7:312.

Reference is made to so-called "avenized" papers, treated with "Avenex", an antioxidant prepared from oat flour. They are recommended for wrapping edible merchandise containing fat or oily substances on account of their rancidity-preventing properties.

221. Laudani, Hamilton, Davis, Dean F., and Swank, George R. A laboratory method of evaluating the repellency of treated paper to stored-product insects. Tappi 38, no. 6:336-41(June, 1955); B.I.P.C. 25:874; C.A. 49:10624.

A technique is described for the evaluation of the repellency to stored-product insects of candidate compounds when applied to paper. The method consists of continuously exposing adult flour beetles for five days on an arena composed of equal areas of treated and untreated paper. Tests are run in quadruplicate with ten insects in each replication, the insects being retained on the test papers by open-end glass cylinders. Comparisons of the repellent action of the experimental compounds are made on the basis of the number of insects counted twice daily on the untreated halves of the arena, and then taking the average of the ten readings. A treated standard and an untreated check are included in each species for comparison. An example of the method used to present the results is shown, and data are cited to substantiate the technique.

222. Lavers, C. G. Package structure and WVP. Modern Packaging 22, no. 3:157-9(Nov., 1948); B.I.P.C. 19:264.

The importance of information regarding the effect of the style of container produced from flexible water-vapor barriers or of the method of closure used is emphasized by the fact that the WVP of sheet stock may increase from 1/5 to 60 times after folding, and that the permeability of completed packages may be from 2 to 10 times as high as might be expected from tests of sheet material. Flexible water-vapor barriers used with a fiberboard carton, either as a liner bag or overwrap, give the same protection against water vapor for packages that are not handled; after handling, the liner gives superior protection. The results of a test of such conditions and of tests of various styles of liner bags, closures, and four different materials are tabulated. There was little difference in the water-vapor resistance of various styles of liner bags made from kraft paper laminated to thermo-plastic-coated metal foil (Reynolds A-51) and from wax-coated cellophane. With glassine and unwaxed cellophane, the efficiency of the liner bag decreased as the complexity of construction increased. There was little difference in performance between glued and heat-sealed construction with glassine; with Reynolds A-51, heat sealing was slightly superior; and with cellophane, heat sealing showed definitely less permeability. With glassine and waxed cellophane, an unsealed folded closure was as good as a heat seal; Reynolds A-51 showed but a slight difference, and with unwaxed cellophane, the folded closure was inferior. However, a well-filled package is necessary with the folded closure so that the top of the carton will hold the fold in place.

223. Lavers, C. G. Packaging. VI. The relative merits of various types of bag construction in producing water-vapour resistant packages. Can. J. Research 25 F, no. 1:8-12(Jan., 1947); B.I.P.C. 17:428; Packaging Abstr. 5:550.

Water-vapor penetration was measured on pouch, flat, wedge, and square liner bags fabricated from Reynold's Metal A-51, 300 M.S.A.T. Cellophane coated 40 lb. per ream with a flexible wax composition, 55-lb. laminated bleached glassine, and 300 M.S.A.T. Cellophane. The bags were closed, where the material permitted, by heat-, glue-, and pressure-sealing, and by folding with or without tin-tie closures. When Reynold's Metal A-51 or waxed cellophane was used, excellent water-vapor resistance could be achieved with any of the bag types investigated, and a folded closure was as efficient as a heat-seal. With all materials except 300 M.S.A.T. Cellophane, bags made with glue were almost as good as those with heat-sealed construction. Unwaxed cellophane or glassine provided more protection when the simpler forms of bags (pouch) were used. With unwaxed cellophane, heat-sealing appeared to make a better liner than the use of glue, and a heat- or glue-sealed closure was superior to a double fold.

<u>224</u>. Leaky flat bags from imitation parchment paper. Papier-Ztg. 64, no. 48:1068(June 17, 1939); B.I.P.C. 9:563.

Flat bags made from highly bleached imitation parchment, a quality similar but inferior to glassine, when filled with a pudding powder, burst open along the folds and the ordering firm refused to accept them. The converter, on the other hand, claimed that imitation parchment, especially in a highly bleached condition, does not possess sufficient folding endurance; this kind of paper was specified, however. Tests made by a third party confirmed that the converter was not to blame, and that the paper was unsuited for the purpose employed. Another possibility consists in the paper having had an incorrect, that is, too low, moisture content at the time of conversion; this factor could not be determined at a later date.

<u>225</u>. Lehman, A. J., and Patterson, W. I. F&DA acceptance criteria. Modern Packaging 28, no. 5:115-20, 172-4(Jan., 1955); B.I.P.C. 25:463.

The basic considerations of the Food and Drug Administration in determining the safety of chemicals used in food-packaging materials are explained, and some of the areas that appear safe or unsafe for further development are outlined. In the rapid technological advances to provide products with protection to the point of purchase and better keeping qualities, the treatment may involve special chemicals and lead to the unintentional addition of the chemical to the food. A program for the appraisal of the acceptability of food additives provides extractability tests to show that the foods will not be contaminated by additives and/or experimental proof of the harmlessness of the additive. A general discussion of the problems with various types of packaging materials and acceptable additives includes a section on cellulose materials; dehydroacetic acid, pentachlorophenol, <u>o</u>-phenylphenol, and compounds of zinc could be acceptable with crates, boxes, etc. for handling fresh produce. Antioxidants considered safe in paper wrappings, bags, and envelopes are propyl gallate, thiodipropionic acid and its dilauryl and distearyl esters, gum guaiac, butylated hydroxyanisole, and butylated hydroxytoluene. The methyl and propyl esters of parahydroxybenzoic acid and sorbic acid are two of the newer agents which have been found acceptable as antimycotics where foods are involved. The presently acceptable insecticide for multiwalled and laminated paper bags is a pyrethinpiperonyl butoxide combination; paper boxes and cartons have presented about the same problems as paper bags.

226. Leinbach, F. S. Glassine as a protective wrap. Packaging Catalog, 1943:318, 321-2; B.I.P.C. 14:18.

An outline of the manifold applications of glassine as a wrapping material is given, including bags and combination packages. The properties of glassine are briefly summarized.

227. LeRoy, Robert B. Activities of a bag company's experimental laboratory. Packaging Parade 13, no. 144:68-9(Jan., 1945); B.I.P.C. 15:249.

Reference is made to the different outstanding properties which can be incorporated into the war-developed multiwall paper bags affording complete protection to even highly hygroscopic materials, whether chemicals or foodstuffs. Filled bags have been thrown off the roof of the Bemis experimental laboratory, East Pepperell, Mass., to the concrete sidewalk below without breaking. Bags filled with flour were thrown over a 30-foot waterfall into the Nashua River, pulled out of the river, and laid on the bank one mile below. When opened, the flour was in dry and usable condition. Bags can be filled with hot melts up to 500°F.; they can be made acid- and alkali-proof, and with a high degree of water-vapor moistureproofness. Despite many transfers during a 26-day transit in subzero cold and tropical heat, an experimental carload of bags holding magnesium flux was delivered in 100% perfect condition after a 3000-mile trip.

228. LeRoy, Robert B. Multiwall paper sacks. Chem. Eng. News 27, no. 48:3562-4(Nov. 28, 1949); B.I.P.C. 20:347; C.A. 44:1625; B.A. 1950B, I:378.

Multiwall paper shipping sacks are custom-made, because they can render greater service through low-cost specialization. Since each product packaged has its own requirements, it becomes virtually mandatory to manufacture according to individual specification. Factors of major importance in the final selection of bag type and size, the number and nature of bag walls, and the degree of slack required include: quality and nature of the product to be packaged, amount and type of protection required, capacity unit preferred, volume of material to be packaged within a specified time, methods and machinery used in packaging and handling, available storage conditions, type or types of shipment involved and distances to be traveled, loading practices, compliance with government regulations, over-all costs, and human physical limitations. The sack is virtually a combination of three to six bags in one, arranged in tubular form, so that each carries its proportionate share of the weight of the product. About a dozen types of paper are commonly used, including natural kraft, asphalt-laminated and -impregnated kraft, the former sometimes with sisal reinforcements, highly sized and wet-strength papers, kraft treated with waxes, glassine, separating paper (usually a clay-coated kraft), bleached and dyed krafts, and parchment. The three types of bags in general commercial use are the open-mouth, the valve, and the open-corner bag. The seams and closures must be equivalent or superior in strength to the bag walls. Adhesives are used for bonding the side seams, bottoms are either pasted or tape-sewn, and top closures are many and varied, including sewing, tape-sewing, wire- or rope-tying, stapling, pasting, and taping. Bag users have a wide selection of filling and handling devices with which requirements can be met; multiwall bags lend themselves especially to palletizing operations. However, it must be understood that the best made bag is of little value unless it is properly filled, weighed, and closed. In conclusion, useful suggestions for good multiwall-bag packaging are given. Through proper control of variables it is possible to package even the costliest of chemicals in multiwall paper shipping sacks.

229. Lester, G. R. Role of partition coefficient in permeability of surface layers with low diffusion coefficient. Brit. J. Appl. Phys. 6, no. 3:82-3(March, 1955); Packaging Abstr. 12:351.

Diffusion through a surface film into an underlying layer is examined using Laplace transformation. An important characteristic of the process is the rate at which equilibrium concentrations are attained, and in certain cases this is simply related to the diffusion coefficient of the film and the partition coefficient at the interface.

230. Liberty, G. The Chester bag method of testing water vapour transmission of films. Paper, Film and Foil Converter 29, no. 12:29-31(Dec., 1955); Packaging Abstr. 13:189.

The Chester bag method places the two pieces of film together and heat seals them on three edges to form an open end bag. A small weighed sack containing calcium chloride is inserted into a film bag which is then sealed. The bag is then exposed to 92% R.H. and 100°F. for four days, after which the calcium chloride sack is again weighed. The weight gain of the calcium chloride yields the WVT of the film directly without elaborate calculation.

231. Linda, Frank R. Fungus inhibiting container for peat moss and the like. U. S. patent 2,615,614(Oct. 28, 1952); B.I.P.C. 23:301.

A multiwall paper bag for the shipment of peat moss and the like is impregnated with a suitable fungicidal agent, such as mercury compounds, chlorinated phenols, and metallic naphthenates. The bag is preferably made of wet-strength paper and at least the inner and outer plies are impregnated. The inner ply may be coated with polyethylene or impregnated with a wax composition containing the fungicidal agent.

232. Linda, Frank R. Paper base laminates and bags for packaging tacky polymeric materials. Canadian patent 513,524(June 7, 1955); B.I.P.C. 25:992.

The invention pertains to the packing of materials subject to cold flow (e.g., butyl rubber) in a multiwall paper bag made up of several paper tubes disposed one within the other. The inner ply of the bag is coated with polyethylene, a clay coating surfaced with casein, cellulose acetate, etc. which, on unpacking, will readily become detached from the paper base without permitting paper fibers to adhere to the rubber. The coating material can then be stripped from the rubber surface without difficulty.

233. Lord, A. Additional observations on the prediction of strength of paper bags from paper testing data. Patra Interim Rep. no. 70a, Leatherhead, Surrey. 1953. 5 p.; Packaging Abstr. 10:401.

234. Louden, William. Wet-strength paper opens new horizons. Wood 2, no. 6:22-4, 42-3(June, 1947); B.I.P.C. 17:664.

Tear and tensile strengths are the most important single properties of paper bags. The strength of an individual sheet of bag paper may be altered by: (1) the type of pulp, with rag pulp (seldom used) best, and then kraft, sulfite, and sulfite-groundwood, in that order; (2) the more hydrated or refined the pulp, the higher the tensile and Mullen; (3) rosin, when used with sufficient alum, has an adverse effect on strength, whereas urea formaldehydes and starch improve the strength; (4) generally, the heavier the sheet, the greater the strength; (5) the lower the temperature of the rolls during sheet formation, the greater the tensile strength; and (6) in general, the higher the pressure of the calender rolls, the more dense the sheet and the higher the tensile strength. For the production of wet-strength bag paper, the urea-formaldehyde resin is usually diluted with water to 5-10% solids to insure good mixing, and added to the pulp in the beater or after refining operations. Optimum wet strength is obtained by adjusting the pH of the pulp to 4-4.9 with aluminum sulfate. For most commercial bag papers, 2.3% resin solids on bone-dry pulp is sufficient to produce good results. For best results, the paper must be aged for 7-21 days. Tear strength is affected by: (1) formation—there should be as little general alignment of fibers in one prevailing direction as possible; (2) refining and tear strength vary inversely; (3) rag, kraft, sulfite, and sulfite-groundwood pulps vary in that order in diminishing tear strength; and (4) a lower calender pressure results in a sheet with higher tear strength. Some desirable properties of bag paper are considered.

235. McAusland, Robert D., Pierce, Robert E., and Ottinger, August F. Bag. Canadian patent 506,758(Oct. 26, 1954); B.I.P.C. 25:339.

A nonslip strip composed of rubber latex or microcrystalline waxes with an abrasive material such as sawdust, sand, or pumice is applied by roller coating or spraying to the center portion of both sides of large paper bags, especially multiwall bags. The coated areas of stacked bags are in contact to prevent slippage in the stack. Only a very thin coating of the material need be applied so that printed information on the bag is not obscured.

236. McGimpsey, W. W. On the "scuffing" of paper bags. Food Technol. 4, no. 10:2[General section](Oct., 1950); B.I.P.C. 21:191; Packaging Abstr. 8:184.

One of the difficulties experienced in routing and switching paper bags from one conveyor belt to another is the tendency of the bag to scuff. The term scuff refers to a characteristic of the outer ply to peel when moved along a surface under pressure, and to the tendency of small abraded spots to enlarge in area and depth into the paper. Available corrective measures are based on three phases of behavior of natural kraft paper: (1) the felt side of the sheet shows less tendency to scuff than the wire side; (2) the scuffing is directional and therefore may be decreased by turning bags on the belt by 180° so that the direction of the sheet most resistant to scuffing receives the impact of forces responsible for the damage; (3) a 50-lb. basis-weight paper is much less liable to scuff than a 60-lb. weight under similar conditions.

237. McMillan, J. G. Shock test for plastic films. Modern Packaging 27, no. 12:119-23, 188(Aug., 1954); Packaging Abstr. 11:1038.

A simple method of detecting flaws that may cause failure of polyethylene and other bags is described. Although the test is somewhat crude, certain salient points have been established: (1) From the standpoint of shock resistance, it is not always advisable to print polyethylene all the way around the gussets. (2) Some types of treatment to make polyethylene receptive to printing tend to degrade the shock resistance. It remains for the converter, the extruder, as well as the manufacturer of plastic resins for films to adopt some kind of drop shock test, in order to achieve the desirable quality.

238. McSwain, Claude W. Automatic drop-test machine suitable for testing bags and sacks. U. S. patent 2,159,036(May 23, 1939); C.A. 33:6665.

Various structural, mechanical and operative details are given for a bag and sack testing machine.

239. Madras, S., McIntosh, R. L., and Mason, S. G. A preliminary study of the permeability of cellophane to liquids. Can. J. Research 27 B, no. 9:764-79(Sept., 1949); B.I.P.C. 20:162.

The permeability of swollen cellophane accommodated by solvent exchange to a variety of liquid permeants has been studied. The degree of swelling, as measured by the thickness, has been shown to be retained when the swelling agent is removed by solvent exchange. Progressive swelling causes a controllable increase in the permeability to a given liquid, but the permeability coefficient K at a given thickness is specific for the liquid. For water and aqueous solutions, K is about five times that of organic permeants. Values for the organic liquids are all of the same order of magnitude and show systematic variation with the degree of swelling. For homologous series of alcohols and ketones, K decreases with increasing chain length. Attempts to calculate the effective pore radius and pore number from K and the void fraction were successful only for water and dilute sodium hydroxide solutions, where a radius of $1.5 \times 10^{-7}$ cm. and a pore number of $10^{13}$/sq. cm. were obtained. An independent method based on combined permeability and electrical conductance yielded a value of $3 \times 10^{-7}$ cm. for the effective pore radius. With organic permeants, it is believed that complications introduced by swelling invalidate the application of the equations. The results obtained can be explained on the basis of viscous flow of the liquids through a porous network in which the number and dimensions of the pores vary with the degree of swelling, but evidence in favor of the validity of this mechanism is inconclusive.

240. Mann, E. A. Preserving bags. Am. Fertilizer 31:29(1909); C.A. 3:2617.

A practical experiment demonstrated that a bag (burlap) which had been treated with a strong solution of red kino gum, and then filled with a very strongly acid phosphate and piled with other untreated bags filled with the same material for 6 months was still strong and intact.

241. Mannheim, H. C., Nelson, A. I., and Steinberg, M. P. Testing film package strengths. Modern Packaging 30, no. 9:167-8, 250, 252(May, 1957); B.I.P.C. 27:1416.

A simple fast, and accurate method for evaluating the relative strength of plastic films, film seals, and film bags is described. The apparatus consists of a stainless-steel tube with an annularly grooved brass plate welded to the bottom. Samples are placed between the brass plate and a matching plate, and pressure is applied through the tube. The final pressure attained before the film bursts can be read on an Ashcroft gage equipped with a maximum reading indicator. Application of the test to film samples showed saran to be the strongest film at 75°F., whereas at 195° saran, Mylar, and a Mylar-polyethylene laminate showed relatively small differences in strength.

242. Marathon Corp. New packaging for frozen fruits and vegetables. Packaging Parade 16, no. 187:79(Aug., 1948); B.I.P.C. 19:45.

The new Freeztex frozen fruit and vegetable package consists of the Marapak moisture-vaporproof package enclosed in a protective outer carton of sturdy paperboard. The carton is made of heavy high-grade, duo-waxed, bleached sulfite, manila-lined paperboard; lock end construction ensures easy positive closure. The bag is made of heavy, wet-strength, plasticized, fully bleached paper, the characteristics of which do not change under extreme temperature fluctuations or continued storage at 0°. Special processing provides stretchability, allowing the bags to withstand a 3% expansion of the contents during freezing. The bag coating is a moisture-vaporproof, heat-sealing, wax-rubber-type, odorless, and tasteless formulation, which remains soft and pliable at extreme temperature changes; it seals readily at 180-400°F.

243. March of multiwalls. Chem. Week 70, no. 18:39-40(May 3, 1952); B.I.P.C. 22:691.

In 1951 the chemical industry consumed about one fifth of all multiwall bags sold. They are being used for packaging a wide variety of chemicals for which they are custom-made from high-finish sheets, high-density sheets, high-wet strength papers, clay-coated papers, and laminated glassine papers. They offer the advantages of economy, cleanliness, and adaptability to automatic weighing and packaging techniques; only where weight and salvage value are important considerations are they inferior to steel or fiber drums and fabric bags.

244. The Maritime Association of the Port of New York. Packaging Committee. Export packaging study. II. Analysis of outturn reports. Fibre Containers 35, no. 6:55-6(June, 1950); Paper Trade J. 130, no. 19:36-7 (May 11, 1950); Am. Boxmaker 39, no. 6:28-30(June, 1950); Packaging Parade 18, no. 209:92(June, 1950); B.I.P.C. 20:814.

In this second report an analysis of the outturn reports at the time of discharge of the cargo at different ports throughout the world is presented. However, it should be borne in mind that additional damage and pilferage may be expected while the shipments are in transit from the foreign ports to their final destination. Data are given on the commodity groups showing damage (textiles, auto parts, glassware, food, agricultural equipment, and pharmaceuticals), the causes of damage (packaging, 65%; discharge, 15%; pilferage, 10%; stowage, 7%; and loading, 3%), and the condition of the different containers (nailed wooden boxes; corrugated containers; solid fiber containers; cleated plywood boxes; cleated fiber panels; open and sheathed crates; wirebound boxes; steel, plywood, and fiber drum; wood barrels; compressed bales; bundles; and textile and paper bags).

245. Marriott, Robert H. Polyethylene as a packaging material. Brit. Packer 16, no. 6:417-19(June, 1954); B.I.P.C. 24:1003; Packaging Abstr. 11:748.

The use of polyethylene as a packaging material for cosmetics is discussed; properties of the film which make it especially suitable are a relatively low specific gravity, resistance to molds and micro-organisms, and flexibility allowing the squeeze ejection of the contents. Although polyethylene is impervious to water, it allows water vapor to diffuse through it; it is more porous than rubber hydrochloride but less than polyvinyl chloride. It is also permeable to such gases as nitrogen, oxygen, hydrogen, and carbon dioxide. Experiments are reported on the application of a polyethylene container for any preparation containing water; it is concluded that with water content an internal pressure will develop at a rate depending on the thickness of the walls and the actual conditions (temperature and humidity) under which it is stored. The ideal environment for storage is a cool damp place free from draughts; the package should be enclosed in an outer container which will protect it from variations in external humidity and temperature. However, in warmer countries, particularly those with high humidities, further protection may be necessary.

246. Measurement of polyethylene film. Tappi 38, no. 4:122A(April, 1955); Packaging Abstr. 12:523.

The extruding machines at Carthage and Three Rivers which apply polyethylene coatings to kraft paper have recently been equipped with instruments using high-speed electron rays emitted by radioactive thallium to measure the film after it is applied. The instruments are traversed across the paper while it is being coated. This enables the operator to control the weight of the film both lengthwise and across the sheet.

247. Measures moisture in packaging materials. Packaging Parade 23, no. 275:105(Dec., 1955); Packaging Abstr. 13:199.

Two portable electronic measuring instruments register the moisture content of such materials as cellulose film, polyethylene container boards and multiwall bags. One is for irregular surfaces and rolls and the other for flat surfaces and thin stacks. The units operate on a patented principle of high frequency power absorption, permitting measurements to both higher and lower moisture ranges than is customarily possible.

248. The mechanical properties of paper bags. Verpackungs Rundschau no. 8:suppl. 49-55(Aug., 1955); Packaging Abstr. 13:214.

In order to determine the strains and stresses to which bags are subjected on packaging machinery and in transport, laboratory tests were undertaken with papers of 20 varying qualities. Table and histograms show the variations in the different properties. Particular emphasis is given to folding and creasing strains. The laboratory tests were checked against actual transport tests.

249. Meyer, J. A., Rogers, C., Stannett, V., and Szwarc, M. Studies in the gas and vapor permeability of plastic films and coated papers. 3. The permeation of mixed gases and vapors. Tappi 40, no. 3:142-6(March, 1957); Packaging Abstr. 14:549; B.I.P.C. 27:992.

The permeability constants of a number of plastic films have been measured for nitrogen, oxygen and helium. The measurements were made both with the gases in the pure state and mixed with varying amounts of carbon dioxide. When adequate mixing of the gases was ensured, no differences in the permeability constants were found between the pure and the mixed gases. The effect of water vapor on gas transmission and of gas on water-vapor transmission has been studied for three plastic films. With the two hydrophobic films no effect was found, but with the hydrophilic film the rate of gas transmission increased with increasing relative humidity. No effect of gas on water-vapor transmission was found.

250. Miller, Philip, Lenaeus, G. A., Saeman, W. C., and Dokken, M. N. Production of grained ammonium nitrate; conditioning treatment, and moisture-proof bags. Ind. Eng. Chem. 38, no. 7:709-18(July, 1946); C.A. 40:7479.

Conditioning of granular ammonium nitrate consisted in adding either 1% of a coating agent, such as a 1:3:1 mixture of petrolatum, rosin and paraffin, 4% of one of several dusts such as kaolin, or a combination of both. The combination treatment gave a satisfactory product for direct application while a dust used alone was less satisfactory as was the use of a coating treatment alone. Paper bags, both moistureproof and multiwall, were more effective than asphalted burlap bags in protecting ammonium nitrate from atmospheric moisture during storage.

251. Modulus testing machine. Ind. Packaging 1, no. 5:53-4(May, 1955); Packaging Abstr. 13:34.

The machine measures the dynamic damping and elastic properties of rubber, rubberlike materials, and plastics under conditions of strain, temperature, and frequency. It is possible to apply static prestrain in the direction of the dynamic strain and also perpendicular to the direction of dynamic strain.

252. Moisture vapour transmission characteristics of various barrier materials. Australian Plastics 12, no. 131:40(1956); Packaging Abstr. 14:5.

The moisture-vapor transmission characteristics of commonly used barrier materials, as well as those of unsupported polyethylene film, are tabulated. Values for both creased and uncreased sheets are shown. Polyethylene-coated paper and polyethylene-wax coated paper are the only coated products whose moisture-vapor transmission characteristics showed no measurable effects after being creased.

253. Moore, J. S. Rate of moisture gain or loss in kraft paper and board. Tappi, 39, no. 6:195-6A(June, 1956); Packaging Abstr. 13:731; B.I.P.C. 26:922.

The purpose of the investigation was to determine the conditioning time necessary for paper and board to reach an acceptable moisture content for testing and the rate at which paper and board gain or lose moisture when converted or used under extremely damp or dry conditions. The following conclusions were drawn: (1) Heavier papers condition slower than lighter weights. Some heavier boards appear not to reach equilibrium even after 24 hours exposure if the original moisture content is considerably different from the equilibrium level. (2) For papers below 80-lb. basic weight, exposure for about 15 min. at 73°F. and 50% R.H. should be sufficient for most control testing if good air circulation is ensured. Care should be taken to have the sample below 6% moisture content before placing it in the conditioning atmosphere. Fifteen minutes preconditioning at 35% R.H. should be enough, even though TAPPI specifies more drastic preconditioning. (3) Moisture content changes rapidly when paper or board of normal moisture content is first exposed to extremely dry or damp atmospheres. However, the exposure time on most converting machinery is too short for relative humidity at the point of conversion to have much effect on moisture content or strength. (4) In most end uses, paper and board will be exposed for a long enough time for relative humidity to have a marked effect on the moisture content, and therefore on the strength. The results refer to paper conditioned in the form of strips of paper hung up singly.

254. Müller, K. The diffusion coefficient as an index of the gasproof properties of raw plastics packaging materials. Opakowanie 3, no. 1:18-20 (1957); Packaging Abstr. 14:549.

The article demonstrates, on laws of diffusion and on measurements taken, that the present means of expressing the gasproof properties of plastic packaging materials in g./sq.m./24 hr. is inadequate. In lieu of the index applied up to now, the constant of diffusion is suggested, giving simultaneously the parameters of temperature and humidity. Moreover, it has been asserted that in following the kinetics of gas penetration it is advisable, besides giving the constant of diffusion, to give also the value of the coefficient 'a' which expresses the speed of equalization of the difference of pressure by the unit value of the a/m constant. In addition, the complete characteristics of the gasproof properties of six plastics packaging materials have been given at a temperature of 10°C. and a relative humidity of 75%.

255. Muldoon, T. J., and Couch, R. de S. Fatigue test reveals new paper performance data. Am. Paper Converter 51, no. 8:10-11, 44, 46(Aug., 1951); B.I.P.C. 22:428.

Based on the concept of fatigue in paper, a new test instrument was designed by General Foods Corp. to apply repeated impacts on flat and creased sections of paper cut from various paper bags. Metal balls are allowed to drop on a rigidly held piece of paper. The number of balls required to fracture the paper is used as an indication of the impact-fatigue strength. The size of the balls and the distance of the drop are correlated with the strength of the paper so that the number of impacts which are required to break a sample is between 15 and 20. Indications are that there is a fairly good correlation between this test and the flat sheet and drop test with glassine and kraft paper. The test will pick out large variations in performance, but more data will be necessary to determine its accuracy when measuring small differences. The variables which have to be controlled include the moisture content of the paper, the grain direction of the paper in the test instrument, the size of the balls, and the height of the drop. Although the number of grades of paper that can be evaluated accurately by this test has not been determined as yet, for those grades which have been tested, it appears to predict with fair accuracy the performance which may be expected of a bag made from these grades of paper.

256. Multiple-wall paper bags. Rule 40. In Uniform Freight Classification 4. Ratings, Rules and Regulations. p. 166-7. Chicago, Ill., Uniform Classification Committee, June 20, 1957.

Specifications for shipping multiple-wall paper bags are given.

257. Multiwall bags, properties and modern uses. Modern Packaging 17, no. 1:79-82, 108(Sept., 1943); B.I.P.C. 14:57.

The development, number and types of plies, packing and closing, and testing procedures of multiwall bags are described. The multiwall bag is custom made, depending upon the chemical and physical properties of the product to be packaged. Size, construction, closing, sealing and filling methods are recommended by the manufacturer after studying the plant conditions in which the product is made; special treatments, finishes, coatings and impregnations for the plies are suggested in accordance with the properties of the commodity in question.

258. Multiwall paper bags for packaging asphalt. J. Franklin Inst. 254, no. 3:266(Sept., 1952); Chem. Eng. News 30, no. 36:3770(Sept. 8, 1952); Packaging Parade 20, no. 237:146(Oct., 1952); B.I.P.C. 23:124.

The Engineer Research and Development Laboratories, Fort Belvoir, Va. are investigating the practicability of packaging certain types of asphalt in multiwall bags for shipment to Army construction engineers in all parts of the world. The asphalt is loaded into the bags holding 100 pounds each in liquid form, while the bags are held in wooden scaffolds to help them retain their shape. A clay coating on the inner bag liner prevents sticking of the hot asphalt to the paper and facilitates stripping of the bag from the contents. After filling, the bags must be stored for approximately 24 hours during which time the asphalt cools and hardens. Exposure, handling, and storage tests at low and high temperatures have been conducted; although deficient in some respects, the bags show promise of meeting the stiff military requirements.

259. Multiwall paper bags subdue Niagara Falls. Packaging Parade 13, no. 155:78-9(Dec., 1945); Chemurgic Digest 5, no. 7:133(April 15, 1946); Chem. Eng. News 23, no. 20:1896(Oct. 25, 1945); B.I.P.C. 16:244.

Reference is made to a recent experiment carried out with Bemis multiwall waterproof paper bags, carrying 50 pounds of flour each, which were thrown into the Niagara River half a mile above the Falls, and swept over the Falls to the lower level. The bags survived this extreme test, but only one of them could be recovered because of the speed of the current. The bag was removed from the water seven-and-a-half hours after the experiment began, intact and capable of being shipped as a commercial container.

260. Myers, A. W., Rogers, C. E., Stannett, V., and Szwarc, M. Permeability of polyethylene to gases and vapors. Modern Plastics 34, no. 9:157-8, 160, 162, 164-5(May, 1957); Packaging Abstr. 14:550.

The report deals with the effects of the various modifications of the original polyethylene on the gas and vapor-transmission rates. Among the modifications discussed are the effect of crystallinity, of irradiation, of a paper substrate, and the effect of grafting other monomers on to the polyethylene by irradiation in the presence of monomer.

261. National Retail Dry Goods Association. Retailers to use fewer sizes of bags and boxes. Am. Paper Merchant 37, no. 7:12-13(July, 1940); Paper & Paper Products 81, no. 21:1, 10(July 20, 1940); B.I.P.C. 10:473.

Reference is made to the publication of the "Wrapping supply manual" by the above association containing revised size standards for bags, folding, set-up, and corrugated boxes, and corrugated rolls. The use of 22 standard paper bag sizes instead of the previous 343 sizes is suggested and similar reductions in the number of the different kinds of boxes are included in the manual. Specifications of the 22 sizes of paper bags are given in a table.

262. Nelson, Alvin I., Hu, Kwoh H., and Steinberg, Marvin P. Heat-processible food films. Modern Packaging 29, no. 10:173-9, 248, 250-1(June, 1956); B.I.P.C. 26:922; Packaging Abstr. 13:668.

As a preliminary to studies on the possibility of the commercial use of plastic films for heat-processed foods, some simple screening tests were performed to eliminate those films whose appearance was greatly impaired by exposure to high temperatures or which exhibited unacceptable tastes or odors. Films were eliminated when they failed in any of the tests, which comprised the following: (1) 30 minutes in boiling water and 30 minutes in 250°F. steam at 15 pounds pressure; (2) smelling and tasting and 30 minutes immersion in boiling water, then measurement of turbidity; (3) determination of permeability (water vapor and gas); (4) actual packaging tests; (5) treatment with a water and air superimposing retort; and (6) measurement of heat penetration. Pliofilm, polyethylene, and cellophane were eliminated after the first step; Tygon, vinyl, and saran films failed in the second test. Teflon was omitted because it was available only in sheet form and could not be satisfactorily heat sealed. Therefore, Mylar polyester A and Trithene A were the only two films left for further heat-stability and food-packaging tests. Data are given on the results of the remaining tests with these two materials.

263. Nelson, Harry H., and Becker, Guillaume. Waterproofed paper or cloth. U. S. patent 2,011,156(Aug. 13, 1935); C.A. 29:6760.

A formed paper or cloth web is moistened with a dilute solution of thiosulfocarbonate, then is impregnated with a solution of freshly prepared cellulose thiosulfocarbonate, and hydrocellulose constituting the binder of the cellulose fibers is precipitated by means of a coagulant of viscose of weak acidity. The product thus obtained is suitable for bags for holding plaster, etc.

264. Nelson, Theodore J. Hygroscopicity of sugar and other factors affecting retention of quality. Food Technology 3, no. 10:347-51(Oct., 1949).

A special, uniformly asphalted laminated sheet was developed for the packaging of sugar. Tests with the laminated paper itself, and with completed bags showed the value of uniform application of the asphalt in a continuous film. It was necessary to use an asphalt film that was not easily cracked when the bags became wrinkled and was not easily forced through the pores of the paper laminae when subjected to the pressure of high storage piles.

265. Nelson, Theodore J. Standards tests for bags. Chem. Eng. News 22, no. 22:2038(Nov. 25, 1944); B.I.P.C. 15:174; Packaging Abstr. 2:296.

With reference to the tests on paper bags performed by the Quartermaster Corps, a communication from the California and Hawaiian Sugar Refining Corp., Ltd. has been received. A puncture test is described, in which the bags are placed horizontally on the floor, a wide iron pipe is placed upright on the flat surface of the bag and an iron shaft dropped through the pipe from different heights onto the bag. The height of drop causing punctures in one out of three tests is determined, each test spot being hit only once by the shaft.

266. Neoprene-treated paper's new look. Paper Ind. 36, no. 6:593-4 (Sept., 1954); B.I.P.C. 25:129.

The application of sensitized Neoprene latex to pulp in the beater or by the saturating technique is described; the resulting improvements include: increases in tensile strength, elongation, bursting strength, impact and shock resistance, folding endurance, scuff resistance, internal bond strength and resistance to chemicals. The greatest impact Neoprene will have on the development of paper products is that of imparting unusually high wet strength and elastic properties; it may find application in multiwall bags, reinforced fiber yarns, filter papers for used lubricating oils and 10% mineral acid solutions, backing for pressure-sensitive stickers, and similar items.

267. A new bag liner that breathes. Fibre Containers 31, no. 8:189 (Aug., 1946); B.I.P.C. 17:132.

A wartime development that may have peacetime applications in connection with paperboard containers is Aquastop, a case-liner material produced by Protective Coatings Corp. It is a synthetic, impregnated, coated, and chemically treated fabric, appearing much like oilcloth. It is strong, tough, flexible, and resilient; however, its outstanding characteristic is that, although it is waterproof, it breathes so that it has a moistureproof transfer rate as high as 10 g./100 sq. in./24 hours. Fruits or vegetables can be packed in it with water ice, because the material is indefinitely waterproof. However, products may also be packed with dry ice, because the liner's high permeability will permit the escape of carbon dioxide gas released from the dry ice. The material may also be used as a liner when packaging mechanical and electrical equipment. It may be obtained in the form of prefabricated bags, according to size specifications. It may be subjected to temperatures of -20° to +175°F. without tackiness, cracking, loss of flexibility, or loss of waterproofness. It heat seals at temperatures of 265° to 310°F.

268. New bag standards. Paper & Twine J. 17, no. 1:11-12, 23-4(March, 1943); B.I.P.C. 13:413.

A discussion of order L-261 issued by the War Production Board is presented. The regulations to standardize and simplify paper bags will reduce the number of sizes from 284 to 117. Specification tables for grocers' and variety bags are included.

269. New cellophane flex tester. Gravure 2, no. 10:52(Oct., 1956); Packaging Abstr. 13:1017.

This unit was designed to reproduce to some degree the old hand flex operation used to determine the durability of cellulose film. The effect of printing and other drying operations on durability of the film can be readily evaluated with the flex tester by checking samples taken before and after processing. The operation of the device is described.

270. New impact testing machine. Modern Packaging 30, no. 12:152 (Aug., 1957); Packaging Abstr. 14:928.

Impact strength for plastics, paper, cellulose film, boxboard and similar materials is found by measuring the energy lost by a swinging pendulum when it breaks through a sample. Energy of the pendulum on an uninterrupted swing is compared with its energy after breaking the sample. Distance is not measured directly on the tester, but is calculated from the pendulum swing time.

271. New tester for measuring gradually increasing as well as intermittent (jerky) tensile stresses of paper and board. Allgem. Papier-Rundschau no. 11:560(June 15, 1950); B.I.P.C. 21:337.

A brief description is given of a new tensile tester which was developed by J. Bekk and is built by A. van der Korput in Baarn, Holland. The instrument can be used for measuring either slowly increasing stresses or those of an intermittent (jerky) nature, to which paper bags may be particularly subjected. The results of the two measurements are quite independent of each other. Many paper types are much less resistant to intermittent tensile stresses in the machine than in the cross-machine direction, a phenomenon which is not encountered with gradually increasing stresses.

272. New use for VCI. Modern Packaging 27, no. 2:156-60(Oct., 1953); B.I.P.C. 24:216.

New forms and applications of volatile corrosion inhibitors in shipping packaging are described. The chemical, applied to the inside of the packaging medium (paper, cartons, envelopes, and bags), slowly gives off an invisible vapor which prevents corrosion of precision metal parts. The chemical will inhibit the action of rust on ferrous metal and corrosion on aluminum alloys; it is not recommended for other nonferrous metals. The effective range of the vapor is not more than 12 inches. A hermetic seal is not necessary, but a good closing is desirable to prevent rapid escape of the vapor. The chemical is reported to be nontoxic to humans.

273. New Zealand Co-operative Dairy Co. Paper bags for powdered milk. Paper Trade J. 130, no. 17:18(April 27, 1950); Packaging Abstr. 7:509.

Six-ply paper bags designed to carry 56 lb. of powdered milk for overseas shipment are being tested. One ply is of water-vapor resistant sheeting, the remaining five being heavy-duty kraft. The bags are double-sewn and glued top and bottom; filling taking place through a sleeve valve which can be sealed against moisture vapor.

274. Nicks, J. J. Standardization of tentative test method of determining degree of roughness or smoothness of flat multiwall bag kraft paper. Proc. 16th Ann. Forum, Part 1. p. 1-3. New York, Packaging Institute; Packaging Abstr. 12:704.

The reasons for different types of finish are stated. The test methods investigated by the Bag Committee of the Packaging Institute were the incline impact, inclined plane and the Gurley smoothness tests. The first proved impractical, the second was also unsatisfactory, but the results of tests made on the Gurley tester led the committee to propose a test procedure, which is described.

275. Ninnemann, Karl W. New pendulum impact tester. Modern Packaging 30, no. 3:163-6, 168, 244, 249(Nov., 1956); B.I.P.C. 27:816.

Developed primarily for determining the impact strength of polyethylene film, the Olin pendulum impact tester can be used for testing materials ranging from thin fragile films to high-strength paperboard by interchangeable impacting heads and pendulum weights. Results obtained using the pendulum tester, which comprises a pendulum with impact head suspended below the major mass of the pendulum, were compared with results for the same test samples in the bag drop test. A correlation coefficient of -0.78, derived by plotting data from both tests, indicates that a relationship does exist and that the pendulum test, a more convenient laboratory test, is an excellent measure of the degree of toughness of a packaging material.

276. No shipping bag better than its closure device. Packaging Parade 12, no. 140:57(Sept., 1944); Modern Packaging 18, no. 2:114(Oct., 1944); B.I.P.C. 15:113.

Reference is made to the "Aquatex" closure for multiwall paper bags. It consists of a tape made of starched crinoline, laminated to double napped flannel. The tape is sewn on the bottom of the bag when it is manufactured and then dipped into a special wax. The latter penetrates the crinoline and is absorbed by the flannel and sewing thread. It is thus diffused between the plies of the paper in the bag forming a ply-by-ply waterproof closure. The same method is used to close the top of the bag after it has been filled. Severe tests, including shipment by rail necessitating several transfers, out-of-doors storage for five months in New England, and rough drop tests after this period, indicated that the bags were capable of protecting their contents: the bags were immediately opened after the tests and the contents were found 100% dry and clean.

277. Nowak, P. Volumetric determination of the water-vapor permeability

of plastics. Kunststoffe 34, no. 6/7:120-1(June, July, 1944); B.I.P.C. 16:151.

The author describes a method for measuring the water-vapor permeability of plastic materials of interest to the electrical industry. Tubes of the synthetic materials are placed in a water-vapor saturated atmosphere and dry air is pumped through the tubes. The air which has passed through the tubes and picked up water vapor that has diffused through the walls of the tubes is passed through molten cinnamoyl chloride at 60°C. and thence through water, where the hydrochloric acid formed by the reaction of water vapor and cinnamoyl chloride is absorbed. The hydrochloric acid is titrated with alkali. The amount of water vapor passing through the tube walls is then known and the water-vapor permeability is calculated from that value, the time of test, and the dimensions of the tubes.

278. O'Connor, D. J. Filled multiwalls in transit-high speed photo study. Ind. Packaging 1, no. 7:23-6(July, 1955); Packaging Abstr. 13:21.

Tests on filled sacks were undertaken by the Morton Salt Co., in cooperation with the Bemis Bro. Bag Co. Analysis of the damage showed that 60% of the failures occurred at the sewn-taped ends of the bags, approximately equally divided between the ends closed by the manufacturer when the bags were made and the ends closed at the salt plant after the bags were filled. The broken bag ends occurred in the bottom and next to bottom layers. Results were recorded by high-speed photography and will provide a basis for future research.

279. Olsson, I., and Pihl, L. Testing poly-cello pouches. Modern Packaging 30, no. 10:157-8, 160(June, 1957); B.I.P.C. 28:514.

The strength of pouches made of polyethylene laminated to or extrusion coated on cellophane is tested by an instrument consisting principally of two rubber-faced jaws which seal the fourth side of a welded pouch. Through a tongue entering the pouch between the jaws, air is released for inflating the pouch. The air pressure causing failure of the pouch is read on a manometer. The strength of the material is tested by positioning the nonwelded longest edge of the pouch parallel to the jaws; the seal is tested by mounting the bag with a welded side parallel to the jaws.

280. Ordelt, O. New device for testing toughness of plastic films and leather. Chem. Prumysl 5, no. 209:12(1955); C.A. 50:3007; Packaging Abstr. 13:377.

A stiffness tester is described which is a modification of a Soviet testing device improved so as to allow testing at constant temperature and within a temperature range of -30 to +70°. The device is basically a balance of special construction with indicating dial, equipped with a jacketed chamber where the actual testing is done under desired temperature conditions. This is achieved by circulating tempering liquid. The chamber has two sight glasses for observing the sample. The sample is a strip of film or foil 50 by 120 mm. which is shaped into a circular ring of 30 mm. diameter. The ring is pressed (from below) against the pan of the balance loaded with weights by means of a lever. The stiffness is expressed as weight in grams required to produce a flattening of the ring from 30 mm. diameter to 15 mm., which dimension is indicated electrically by a signal light. A diagram and a photograph of the device are given.

281. Othmer, D. F., and Frohlich, G. J. Correlating permeability constants of gases through plastic membranes. Ind. Eng. Chem. 47, no. 5: 1034-40(May, 1955); Packaging Abstr. 12:619.

It has been desired to correlate the permeability as a function of temperature by a method which will be not only simple and readily used but also based on the thermodynamics of the mechanisms involved. A simple method has been developed by which relatively few experimental data can be plotted and extrapolated or interpolated over a wide range of temperature within an accuracy at least as good as that of the experimental data available. Based on the straight-line functions developed, a nomogram has been constructed for some 150 of the many systems reported in the literature. If the values of permeability are known at two temperatures of any additional gas-film system, the nomogram may be used for all other temperatures of such a system.

282. Owen, W. L. Pinning down bag-borne bacteria. Food Eng. 25, no. 1:57-8, 132, 134(Jan., 1953); B.I.P.C. 23:389; Packaging Abstr. 10:252.

With the rigid restrictions proposed by the American bottlers of carbonated beverages--that sugar supplied to them contain no more than 10 molds /10 g.--the possible contamination of bagged refined sugar through the packaging medium was investigated. The methods used for determining the presence, concentration, and distribution of mesophilic micro-organisms per square inch of internal surfaces of paper bags employed by the sugar refineries are described. The results indicate that, although the total numbers of bacteria in the bags are insufficient to contribute materially to the bacterial content of the sugar, they are not uniformly distributed over the entire area and, in some instances, six times as many bacteria were found on the bottom of the bags than on the sides; both molds and viable yeast were found to be present. When the increase in mold and yeast counts before and after bagging of the sugar was checked, the results indicated that the bags not only contributed a definite increase to the mold count of the sugar, but in seven out of nine cases, the increases were sufficient to make the counts exceed the limits prescribed by the bottlers.

283. Packaging Institute. Optimum moisture content in paper sacks. Advis. Serv. Rep. no. 321:11(1953); Packaging Abstr. 10:522.

Optimum moisture range for maximum performance is rated from 5-7%. This can be maintained at temperatures from 60-100°F. at relative humidities between 40 and 60%. Bag size, structure, shape, etc., and the type of packing may determine the humidity required. Data on paper tests of pigment bags show that though tear strength may increase with increased relative humidity, tensile strength may decrease.

284. Packaging of bearings...tremendous trifles. Modern Packaging 19, no. 9:124-9, 174(May, 1946); B.I.P.C. 17:132.

After a detailed, profusely illustrated description of the methods of handling and preparing for packaging high-precision, antifriction bearings, the requirements of the wrapping materials used are outlined. Specially treated types of paper are employed which must undergo rigid tests as to strength, flexibility, and rate of aging, as well as acid content and greaseproof qualities. Tests are made under controlled humidity conditions, with and without moistureproof coating. The packaging requirements for some finer precision bearings include covering with wax-coated cloth, then wax dipping. A metal-foil, heat-sealed bag which, in turn, is enclosed in another vapor- and moistureproof bag, is specified for certain cases. An aluminum foil adaptable to heat-sealing is used in some plants.

285. The packaging of raw sugar. Packaging 26, no. 164:11(1943); Packaging Abstr. 1:28.

High cost and uncertainties in supply of jute bags have led to the trial of two types of bag: (1) Four- or five-ply bags such as those used for cement, and (2) special bags of paper treated with an asphalt emulsion. Those with the asphalt treatment withstood the severest winter conditions and rats. Five-ply bags, the inner sheets of which were treated with asphalt solutions, also withstood the severest treatment in handling and transport. Other products which can be packed in open bags are indicated. This change-over began as far back as 1932.

286. Pakshver, A. B., and Bykova, I. V. Diffusion of various substances through hydrocellulose films. Kolloid. Zhur. 16:381-6(1954); C.A. 49:2821; Packaging Abstr. 12:446.

The diffusion coefficient D sq. cm./sec. of a substance in aqueous solution through a regenerated cellulose film increased in time because the film gradually swelled, e.g., D of caustic soda was $10^{-9}$ through initially dry, and $10^{-6}$ through swollen cellulose film. Even in the steady state, a cellulose film originally dried under tension gave lower D values (e.g., $20 \times 10^{-6}$ for 3.3% sodium hydroxide at 25°) than an undried film ($D = 2.3 \times 10^{-6}$). The former film increased its thickness in 3.3% sodium hydroxide 1.25 times, and the latter 1.48 times. Similar results were obtained for the diffusion of methylene blue and glycerol. Stirring the solution in contact with the film accelerated the diffusion when D was between $10^{-5}$ and $10^{-7}$ but was ineffective at smaller D. D increased with temperature, e.g., from $0.2 \times 10^{-6}$ to $0.3 \times 10^{-6}$ for methylene blue and $0.35 \times 10^{-6}$ to $0.49 \times 10^{-6}$ for glycerol when the temperature rose from 20° to 30°.

287. Paper bags and their possible uses. Verpackungs Rundschau 7, no. 6:45(June, 1956); Metal Box Co. Ltd., Research Division of the Survey of Literature, June, 1956:22; Packaging Abstr. 13:851.

A survey of the manufacture, uses and testing of paper bags.

288. Paper bags for wrapping purposes in the industry. Papeterie 59, no. 1:10, 13-14; no. 2:61-2, 65; no. 3:118, 121, 123(Jan. 10, 25, Feb. 10, 1937); B.I.P.C. 7:275.

The article describes the properties required of paper bags as carriers of heavy articles, including resistance to certain chemical reactions, the advantages of multiwall bags and methods of manufacturing them, bag filling machines and methods for closing them. Correct handling methods and problems involved in the disposal of waste bags are also discussed.

289. Paper carries the load. Can. Pulp Paper Ind. 7, no. 2:20, 25-6 (Feb., 1954); B.I.P.C. 24:574.

St. Regis Paper Co. (Canada) Ltd. and the Consolidated Mining & Smelting Co. of Canada jointly developed a four-ply, polyethylene-lined kraft bag for packaging fertilizer grade of ammonium nitrate, a chemical which absorbs moisture readily. Consignees report that the product arrives in a drier condition and empties better from the bags than before when asphalt-laminated five-ply bags were used. The polyethylene ply remains strong and pliable during cold winters and hot summers. Other satisfactory applications of polyethylene-lined bags include the packaging of peat moss, powdered milk, and meat scraps stored in freezers.

290. Paper gets tough! Resinous Reptr. 8, no. 5:15-17(Sept., 1947); B.I.P.C. 18:197.

Multiwall bags, introduced in 1925, are now used at the rate of one billion per year. The characteristics of the product to be packaged are carefully considered to determine the type of sheets required and the order in which they are to be used in the bag. Each ply performs a special function in addition to contributing to the over-all strength of the bag. Much of paper's versatility in multiwall packaging is accounted for by its water resistance. This was first obtained by the application of urea-formaldehyde resins which produced a brittle sheet. Two such resins, Uformite 467 and 470, are now widely used to give lasting wet strength at low cost. They are added as dilute solutions to the beater or head box. With the use of these resins, the dry tearing strength of the paper is slightly reduced; the wet strength is higher than the dry strength. Dry tensile strength is unaffected, except that any decrease caused by rosin size is offset; pliability, cleanliness, odor, and color are unaffected. Folding endurance is favorably influenced by the use of Uformite 467. This resin (2-3% of the dry weight of the pulp) is suggested for use with kraft pulps, if alum can be used to reduce the pH to 4.0-4.9. Uformite 470 (2-3%) is recommended for head-box addition when sulfite, sulfite-groundwood, or rag pulps are used; it is also employed with kraft pulps if a pH of over 4.9 prevails on the paper machine. The position of the wet-strength paper in the multiwall bag depends on where the moisture will be met.

291. Paper packaging: sizes of bags, small and medium content. Norme Francaise H/11-001. Paris, 1946. 4 p.; Packaging Abstr. 4:182.

Specifications are given for the formation and sizes of a self-opening bag (tuck-in bag—also called a bag with a crossed bottom) with square or rectangular bottom, flat or satchel bag, and flat bag with gussets.

292. Paper shipping sacks for bulk packaging. TAPPI Bull. No. 11 (May 21, 1943). 2 p.

A review of the construction of multiwall sacks and the uses to which they are put.

293. Paper that stretches. Rohm & Haas Reptr. 12, no. 5:18-22(Sept.-Oct., 1954); B.I.P.C. 25:213.

Cindus X-Crepe, a kraft paper creped diagonally in two directions made by Cincinnati Industries Inc., Cincinnati, Ohio, is produced in a single thickness, in laminations with cloth, fibers, films, or foils, and impregnated with wax, resin, rubber, or asphalt. The manufacture, numerous applications, and unusual properties of the paper are described; bags and liners form water- and vaporproof barriers. The material can be sewn, taped, cemented, or handled in any of a number of other ways in the production of finished goods.

294. Parliman, J. H. Liquid transmission through polythene film. Product Eng. 20, no. 3:152(March, 1949); Metal Box Co., Ltd., Research Division of the Survey of Literature, April, 1955:5; Packaging Abstr. 12:619.

A formula is given for calculating the liquid permeability of film from experimental data. The permeabilities of .001 in. polyethylene film to 48 liquids are listed. These liquids include water, organic acids, esters, ethers, ketones, alcohols, halogenated materials, aliphatic and aromatic compounds, and nitrates and other nitrogen-containing materials. The permeability values vary widely between 0.02 g./24 hr./100 sq. in. film for ethylene glycol, and 5,200 g./24 hr./100 sq. in. film for carbon disulfide.

295. Parsons, Herbert L. Calculation of flat dimensions of sacks and bags when the volume to be contained is known. J. Textile Inst. 34, no. 3: T1-18(March, 1943); B.I.P.C. 13:410.

Various formulas have been developed in an endeavor to relate flat dimensions of empty sacks and bags to the volumes they will hold when filled under varying conditions. The method of closure is classified into two types: (1) straight seaming at the top which can be covered with good accuracy, and (2) central gathering and tying which is covered with moderate accuracy. Practical experience in the use of the formulas has shown the results to be useful and satisfactory. Various problems are worked out to show the application of the formulas derived.

296. Petukhov, A. A. Machine for testing paper bags. Bumazh. Prom. no. 5:36-7(Sept.-Oct., 1950); D.S.I.R. Transl. Cont. Lists Russian Period. no. 26:7(May, 1951); Packaging Abstr. 8:535.

A Russian-manufactured drop tester for kraft cement bags is described.

297. Polskiego Komitetu Normalizacvjnego. Specifications for paper boxes, paper cartons, rose bottom paper bags, box shaped paper bags. Spec. PN/P-79000-5. 1949. Each 2 p.; Packaging Abstr. 7:351.

298. Polyethylene films extend the use of paper in packaging. Paper Ind. 37, no. 2:155(May, 1955); B.I.P.C. 25:811.

Crown Zellerbach Corp. is now producing various types of polyethylene-coated papers, including multiwall bags and frozen food wraps. Properties and potential applications of the material are discussed.

299. Polyethylene on paper. Modern Plastics 23, no. 4:67-71(Dec., 1950); Packaging Abstr. 8:152.

The extrusion coating process used by the St. Regis Paper Co. for applying polyethylene to paper is described and illustrated. The results of tests demonstrating the low moisture-vapor transmission of polyethylene-coated papers are given. A polyethylene-coated kraft ply in a multiwall bag is as strong as 2 asphalt-laminated sheets.

300. Poly-Kote sheeting. Chem. Eng. News 32, no. 33:3298(Aug. 16, 1954); Packaging Abstr. 11:1087.

Poly-Kote, a sheet coated with a combination of polyethylene and wax for use in multiwall bags, has been developed by Arkell & Smiths. The sheeting is said to be as equally acid and alkali resistant as straight polyethylene and suited for packaging hygroscopic materials such as synthetic resins, chemicals and fertilizers. A bag lined with Poly-Kote and containing calcium chloride was placed in a humidity cabinet at 100°F. and 90% R.H. for one month. The Poly-Kote kept out moisture and the calcium chloride sample showed no caking.

301. Polythene film burst strength tests. Flexogram, July, 1956:2; Metal Box Co. Ltd., Research Division of the Survey of Literature, Dec., 1956:14; Packaging Abstr. 14:362.

An impact tester has been used by the Central Research Laboratories of the Interchemical Corp. to test the effect of printing on polyethylene film. A steel ball is dropped from a measured height on to a firmly clamped piece of film, the minimum height from which the ball punctures the film being taken as a measure of burst resistance. By comparing the results obtained with printed and unprinted film the effect of the ink on the strength of the film can be estimated. The experiments seem to indicate that ink thickness is the major factor in the weakening of the film on printing. An overprint varnish did not produce weakening, and it is assumed that it is the ink pigment which tends to make the combination of ink and film more brittle than the film alone.

302. Possanner v. Ehrenthal, B. Sulfite as substitute for sulfate pulp. Papier-Fabr. 39, no. 4:21-7(Jan. 25, 1941); B.I.P.C. 11:366.

A comparison was made between the strength properties of a number of kraft and sulfite pulps, including breaking length, stretch, folding endurance, tear, and burst, in order to determine to what extent sulfite pulp could be used in place of sulfate pulp in the manufacture of bags. A tabulation is given of part of the experimental data which were taken under normal conditions of measurement, after exposure to different elevated temperatures, and after reconditioning. The results show conclusively that, for the intended use requirements, sulfite pulps are inferior to sulfate pulps; their strength properties are definitely more affected by drying at 100°C. or by heating to higher temperatures than sulfate pulps; some of them also suffer greater permanent losses in strength after reconditioning. Sulfite bags filled with hot hygroscopic materials will naturally be affected in their strength properties to a greater extent; impregnations carried out at temperatures around 125°C. will likewise have a weakening effect. The suggestion is made to counteract these effects by an aftertreatment with alkali or by embedding hygroscopic substances into the sulfite pulp.

303. Postl, H. Paper for cement sacks. Zellstoff u. Papier 11:144-5 (1931); C.A. 25:3831.

A brief description of the manufacture and properties of paper for cement sacks.

304. Potatoes get a break--bags don't! Resinous Reptr. 9, no. 1: 12-13(Jan., 1948); B.I.P.C. 18:468; Packaging Abstr. 5:234.

The use of multiwall paper bags for potatoes solved the problems of distinctive labeling, prominent display, and protection of the potatoes from exposure to sunlight and strong artificial light, bruising, and evaporation. However, the water of condensation, dripping onto the bags from the walls and ceilings of boxcars, presented new difficulties. The use of Uformite 467 increases the wet strength of paper by 300-400%, and thus results in a very satisfactory multiwall potato bag. Hydrotax bags, made by the St. Regis Co., are well known wherever Maine potatoes are sold. Three sizes have been found to be most popular, holding 10, 15, and 50 pounds each.

305. Preservation of bags for storing superphosphates and sulphur. J. Dept. Agr. West. Australia 15:702-3(1908); C.A. 2:570.

After soaking in a solution of red gum kino, a bag withstood the action of a very acid superphosphate kept in it for six months.

306. Přibyl, J. Paper for bags. Papir a Celulosa 11, no. 8:181-4 (Aug., 1956); Assoc. Tech. Ind. Pap. Feuill. Bibl. no. 3:14(March, 1957); Packaging Abstr. 14:653.

307. Přibyl, Jindřich. The testing of paper sacks. Obaly 2, no. 4: 108-11(Sept., 1956); B.I.P.C. 28:1372; Packaging Abstr. 14:202.

The testing of bag and sack papers in the laboratory, in which the paper is subjected to a gradually increased static stress or strain, gives an inadequate picture of the practical performance of paper bags under dynamic conditions. Systematic drop-test experiments on filled paper sacks have led to the development of a more practical test method for evaluating the suitability of sack papers. Using the new method, a new multi-ply bag having kraft paper as the outermost ply and sewn on both sides has been developed for the combined rail and boat transport of sugar and cement. Three drop testers and a compressed-air test method for paper sacks are described.

308. Přibyl, J. The testing of woven sacks. Obaly 3, no. 2:42-4 (1957); Packaging Abstr. 14:765.

The need for testing woven jute sacks and the trend of tests is mentioned. The question of filtration and durability of sack fabrics and sacks was solved in a single test. The apparatus and testing method used are described. Results of the tests and their applicability are given.

309. Prindle, Karl E. Laminated films, foils, papers. Modern Packaging 18, no. 3:118-19(Nov., 1944); Packaging Parade 12, no. 142:42-6(Nov., 1944); B.I.P.C. 15:171.

A gusset-type bag for the packaging of cocoa is made from a supercalendered plasticized vegetable parchment laminated to a plasticized glassine sheet with a plastic water-vapor resistant adhesive. The bag is constructed with siftproof bottom, very pliable, fairly moisture-vapor resistant, and greaseproof. The most important characteristic is its durability at low and high temperatures.

310. Progress of dehydration. Fibre Containers 27, no. 9:56-9(Sept., 1942); B.I.P.C. 13:72.

After briefly referring to the purpose and goals of dehydration, possible savings, and types of foods to which the process is applied, the packaging problems are discussed. Paperboard and paper seem to present the only likely candidates, with paperboard preferred because of the added protection afforded by its strength and structural characteristics. The necessary refinements of paper containers for protecting dehydrated foods consist principally of means for keeping oxygen and other gases out of the package, keeping desired gases inside the package, and reduce the moisture-vapor transfer to the vanishing point. Most efforts for accomplishing these aims have been along the lines of adding special liners to paperboard or inserting special bags in paperboard cartons. These linings and bags up-to-date have been as follows: (1) glassine laminated to paperboard with an asphalt compound (Tredonia board), (2) moisture-vaporproof cellophane bags which are heat sealed (Thermophane), (3) bags of lead foil, sandwiched between sheets of paper, using asphalt compounds or waxes for laminating, (4) bags of wax-coated parchment. The hay-like flavor of early dehydrated foods is now known to be caused by oxidation when air is allowed to reach the dried foods. Extremely high heat is destructive to flavor and food values. There are several methods of dehydration which may be termed as follows: spray-drying, rack-drying, and conveyor-drying. Spray-drying is applicable to finely divided materials in the form of pastes with high water content, such as milk, eggs, and certain fruits and vegetables. This method is considered best, resulting in minimum damage to color, flavor, and vitamins. Rack- and conveyor-drying are applicable to vegetables and meats, conveyor-drying being preferable because it is less expensive from a labor standpoint as it involves less handling. With rack-drying there is the tendency of certain foods to stick to the trays.

311. Properties and uses of "Carico" sheeting. Brit. Packer 13, no. 12:36-7(1951); Packaging Abstr. 9:160.

Carico sheetings have been developed from Oriac (latex-impregnated linters) sheeting [Brit. Packer 13, no. 8:29(1951)]. The advantage of the material for use as sacks and bags are (1) the ease with which it can be washed and cleaned for re-use; (2) strength retention when wet, (3) good durability and abrasion resistance, (4) the choice of alternative sheetings to give any required degree of water-vaporproofness or porosity, (5) excellent printability, (6) may be sealed by sewing, or by adhesive if an M. V.P. seal is desired, (7) the water-vaporproofed type is nonsupporting to mold growth and the other grades can, if required, be specially moldproofed, (8) resistant to acids and alkalies, (9) resistant to insect attack, (10) on drop tests, showed better results than other sack material. Carico can be used for indestructible labels for packing cases. The manufacturers are Walter Shaw Ltd.

312. Prüssing, Curt. Water permeability of paper sacks. Zement 18: 568-9(1929); C.A. 23:4791.

The penetration of moisture through sack paper can be followed by the decrease in fineness of cement contained therein. Also the time required by heated cement to make a phenolphthalein solution become red through paper is a good index to the permeability of the paper to water. Colored paper is more pervious than is plain paper.

313. Pullman, Joseph C. Twine and process of preparing the same. Canadian patent 530,147(Sept. 11, 1956); B.I.P.C. 27:482.

Strands of natural or synthetic fibrous material, such as cotton or nylon, may be incorporated in a binder or baler twine substitute produced by a process similar to the one disclosed in Canadian patent 530,643 (Sept. 18, 1956). The strands of organic and/or glass fibers are adhesively imbedded in parallel alignment and in alternate transverse arrangement between paper covers to form a tape which is later twisted into twine.

314. Pullman, Joseph C. Twine and process of preparing the same. Canadian patent 530,642(Sept. 18, 1956); B.I.P.C. 27:482.

Included as objects of this invention are the production of a woven fabric as a substitute for burlap in bag making, and the production of a woven fabric having application as a floor covering. The fabric may be woven entirely or partly of twisted strands composed of a number of spirally parallel glass strands which are adhesively positioned between layers of twisted tissue paper. These strands are made by a process similar to the one disclosed in Canadian patents 530,147(Sept. 11, 1956) and 530,643 (Sept. 18, 1956).

315. Pullman, Joseph C. Twine and process of preparing the same. Canadian patent 530,643(Sept. 18, 1956); B.I.P.C. 27:482.

Strands of glass fibers are adhesively combined with paper by the disclosed process to form a twine claimed as a superior substitute for natural sisal binder and baler twines. In producing the twine, one face of a tissue paper web is coated with adhesive; on one half of the width of the web, a number of adhesive coated strands of glass fibers are imbedded in parallel alignment. The paper is folded to cover the strands and form a flat assembly which is then twisted into a twine. The strands of glass fibers are each composed of about 200 separate filaments. Any adhesive material, including natural or synthetic resinous adhesives, may be employed.

316. Rabak, William. Frozen foods. Modern Packaging 20, no. 6:112-15, 164(Feb., 1947); B.I.P.C. 17:440.

Frozen foods require protection against water-vapor losses and contact with air during freezing storage. To emphasize the perishable quality of such foods, the industry has tended to use paperboard and other nonhermetical, nonmetal containers, as opposed to the conventional containers for other processed foods. The factors influencing the loss of water vapor from protective packages at low temperatures are: (1) the nature and type of the package or material; (2) duration of the holding period; (3) the relative humidity of the storage space; (4) the efficiency of seals; (5) the velocity or amount of circulation of air in the storage space; (6) the area of exposed surface of the package; (7) temperature fluctuations of the storage space; and (8) temperature of the storage space. Of interest to the industry are water-vapor resistant sheets such as rubber latex, rubber hydrochloride, and moistureproof cellophane, all types of double-waxed and laminated paper sheets, and double wrapping. A study of the efficiencies of various types of packages of frozen peas showed that paperboard packages with heat-sealed bag liners or overwraps, stored for 20 months at 15°F., allowed about twice as great a weight loss as those stored at 0°F. for the same time, under reasonably constant humidity. For long storage periods, the extent of weight loss was found to be governed by the relative water-vapor resistance of the liner or wrap and the sealing thereof. Investigations have been conducted at the Western Regional Research Laboratory on the value of using an uninterrupted thermoplastic film applied as a dip coating to the frozen product or to the package containing it. This procedure reduces oxidation, prevents loss of moisture, and minimizes the danger of "freezer burn." At present, dip coatings with a plasticized paraffin base or some of the micro-crystalline paraffins seem most suitable and available.

317. Ragossnig, L. The dynamic strength of kraft bag papers. Österr. Papier-Ztg. 56, no. 11:11; no. 12:7(1950); Tech. Bull. Tech. Sect., Brit. Paper and Board Makers' Assoc. 28, no. 7-9:51(July-Sept., 1951); World's Paper Trade Rev. 139, no. 21:1579-80, 1582, 1584, 1589-90, 1592(May 21, 1953)(English translation); B.I.P.C. 22:848; 24:44; Packaging Abstr. 9:20.

As known from practical operation, the data generally used for testing paper strength, such as breaking length, bursting strength, tensile strength, and stretch, do not represent useful criteria for evaluating the strength of bag papers in usage. The strength of a paper is, to a great extent, caused by bonds between the individual fibers. By a free fall of a filled paper bag, a portion of this strength is destroyed, because a certain number of the elements become separated from each other. In repeated falls, the strength counteracting the energy of fall will be smaller than in the first drop, so that the number of elements torn from each other will become greater with each successive drop until the bag finally breaks. The author carried out experiments and calculations to investigate the strength of bag paper under dynamic stress; he used suitable testing apparatus which he developed especially for this purpose, in which he employed cylinders of test paper filled with lead shot. He introduces three terms for the calculations presented in the article: the general dynamic strength modulus (I), the primary dynamic strength (II), and the breaking constant (III). (III) characterizes the degree of the decrease in strength during repeated stresses, and (II) may be determined by destroying the primary strength with a single application of a sufficiently large dynamic stress and determining the energy used. (II) and (III) represent generally valid criteria for the dynamic strength of bag papers. Papers with a high (II) are resistant to momentarily applied forces, such as when bags are thrown. A small value for (III) indicates resistance of a paper toward repeated applications of low energy. This will explain the purposes for which slightly creped paper is useful, even though its tensile strength is relatively low. Its (II) values are, in general, higher than those for uncreped papers of the same substance; in addition, its (III) value in the elastic range is lower than for other papers because of its extreme pliability. If the applied stresses in practice lie within the elastic range (which is generally the case), the life of a slightly creped paper bag exceeds that of uncreped paper bags. It was also found that the (II) value of the bag papers cannot be increased with increased beating degree. If (II) is principally considered, it is uneconomical to beat beyond 30° S.-R., although lower (III) values may be obtained by longer beating in the case of uncreped bag papers. For creped papers, a higher beating degree affects only the (III) value in the adhesion zone which is of no importance to its resistance against applied energy, since its very loose structure is completely destroyed after passing the strain limit.

318. Ranalli, F. Studies on the permeability of polyethylene. Materie plastiche 21, no. 9:736-44(1955); Brit. Plastics Federation Abstr. 10, no. 10:765(Oct., 1955); Packaging Abstr. 13:7.

A method is given for determining the permeability of polyethylene to liquids and vapors. The effect of temperature and thickness of the polyethylene film on the permeability is discussed and shown graphically. Permeability figures are listed for a number of materials.

319. Rance, H. F. Some new studies in the strength properties of paper. World's Paper Trade Rev. 131, no. 3:Tech. Sup. 1-7; no. 7:Tech. Sup. 9-13(Jan. 20, Feb. 17, 1949); B.I.P.C. 19:561.

The author postulates that the conventional methods of strength testing are not only inadequate, but often give misleading information to the papermaker and user. The new rheological approach differs in two important respects from traditional approaches. It pays particular attention to the prerupture stress-strain characteristics, instead of concentrating merely upon rupture strength, and it emphasizes the importance of the time factor, both in the testing and usage of the materials. Until fairly recently, paper has not been seriously studied by the methods of rheology and even to date, there exist few appropriate references. After reviewing the pertinent researches by Gibbon, Farebrother, Steenberg and Ivarsson, and Mason, the author refers briefly to a few of the more salient features of the work carried out in the laboratories of Wiggins, Teape and Co., with which he is connected. The rheological studies were originally started to obtain more information about the directional differences in paper, with particular reference to the old problem of dimensional stability under changing humidity. He discusses the first fairly crude arrangements for obtaining stress-strain diagrams for tensile loading, in which evidence of creep phenomena and apparent flow were obtained (a specially impressive demonstration being an experiment where a strip of paper broke under deloading); the development of a system of empirical strain analysis (the division of deformation under a given load being divided into three components: the elastic, the reversible plastic or delayed elastic, and the irreversible plastic components); the relation between plastic flow and wet expansion (prestraining of a paper strip reduces the wet expansion by an amount more or less proportional to the degree of permanent set which has been incorporated into the paper, the shrinkage of the wet web is visualized as being caused by the twisting, coiling up, and kinking of all the fibers in the sheet (in the machine direction, the tensions prevent these effects, whereas in the cross-machine direction there is freedom for shrinkage); the use of a stress-strain curve for predicting the folding endurance of paper; and, finally, the relation between rupture and prerupture characteristics of paper. The author argues that the practical strength of paper is as much determined by its ability to stretch as by its ability to take the load, and gives practical examples to show that the usage behavior of a paper is almost invariably determined by a combination of strainability and stressability; there is a real continuity between the prerupture strain process and the rupture itself. In conclusion, he refers to two new stress-strain instruments, Steenberg's universal instrument which functions by electric control, and an instrument developed in the author's laboratory, which is similar to the Cambridge textile Extensometer and whose automatic control is based upon a pneumatically operated servomechanism.

320. Ready-reckoner for paper bags and envelopes. Rev. Papiers 12, no. 15:292-3(Aug. 25, Sept. 10, 1949); Packaging Abstr. 6:859.

A list of standard paper bags and envelopes, their dimensions and the weights of various products with which they can be filled is given.

321. Recommended practice for handling, storage and shipment of material packed in paper shipping sacks. Paper Shipping Sack Manufacturers' Assoc., Inc. General Manual No. 3, Jan. 18, 1953. 39 p.

322. Reich, I. G. Wet-strength papers; an evaluation of the applicability of the impregnating effect with urea resin. Allgem. Papier-Rundschau no. 14:587-94(July 26, 1951); B.I.P.C. 22:209; Packaging Abstr. 8:612.

Most of the previous publications on wet-strength papers evaluate the wet-strengthening effect through the addition of synthetic resins by testing the wet and dry tensile strength, sometimes also the wet and dry burst. However, the influence of the treatment on wet rub, initial tear, folding endurance, absorptivity, etc. has found little consideration, and the reciprocal action between resin addition and sizing, filler retention, dyeing behavior, and groundwood percentage is in most cases not known. The purpose of the present study was the investigation of these factors in a number of papers with particular reference to their use requirements; urea (Urecoll K) was generally employed, and polyethylenimine was used in only a few cases where it offered especial advantages over urea resins. The application to the following types of papers is discussed: wrapping paper; bag paper and bags, including multiwall bags; containers and containerboard; printing, writing, and map paper; wallpaper; filter paper; cleaning paper; sanitary papers; textile bobbins; spinning paper; and concrete road-foundation paper; data on improved wet tensile strength, wet burst, wet initial and interior tear, wet rub, and dimensional stability, depending on use requirements, are given. The effect on inherent desirable properties (which should not be impaired by the treatment), such as dry strength, flexibility, size resistance, smoothness, color, fastness to light, absence of odor, physiological safety, greaseproofness, filtering properties, absorptivity, etc. are given wherever they apply.

323. Reid, J. David, Mazzeno, Laurence W., Jr., and Ward, Kyle, Jr. Decreasing the acid degradation of cotton sewing thread. Textile Research J. 16, no. 1:26-31(Jan., 1946); B.I.P.C. 16:314.

The degradation of cotton sewing thread used to close multiwall paper bags for shipment of triple superphosphate is caused mainly by the halogen acid fumes released from the action of the phosphoric acid upon the halides present. The use on the thread of alkaline sizing agents, or protective coatings such as soap or beeswax, is comparatively inefficient, as is the use of carbonates in the fertilizer to neutralize the acid. However, the use of a mildly alkaline humectant agent, such as triethanolamine, impregnated into the thread in amounts of about 35%, gives good protection in both accelerated trials in laboratory tests and in use tests involving 80-day storage. The amine must be so applied that drying of the thread in bulk at temperatures approaching 212°F. (100°C.) is avoided, for this causes a degradation of the thread. Drying at such temperatures in a single strand, however, introduces no difficulty.

324. Reinhart, F. W., and Mandel, J. Comparison of methods for measuring the tensile and tear properties of plastic films. ASTM Bull. no. 209:50-6(1955); Rubber Abstr. 34, no. 1:30(Jan., 1956); Packaging Abstr. 13:292.

The results of tests on the tensile strength, SPI-ASTM tear resistance, and Elmendorf tear resistance of plastic films show that these are measurements of three different properties or combinations of properties, and one cannot be used in place of another. As a result of the tests, ASTM Method D882 has been revised, and a revision of D1004 is under way. Some factors that are not specified at present need consideration so that reproducible results can be obtained. The methods of test and the results are reported in detail.

325. Reitlinger, S. A., and Yarkho, I. S. Gas permeability of crystallizing polymers. Kolloid Zhur. 17:387-90(1955); C.A. 50:2248; Packaging Abstr. 13:378.

Permeability of stretched gutta-percha, polyethylene, and polyamide was smaller than that before stretching; e.g., for hydrogen at 20° the coefficient K was, respectively, 10, 6, and 0.3 before, and 8, 3 and 0.15 x $10^{-8}$ cc./sec. atmosphere after stretching. Crystallization of natural rubber at -25° lowered K and raised the density of the rubber; identical effects were produced by stretching a vulcanized rubber film. The coefficient of K was raised by stretching polymer films.

326. Resinous Products & Chemical Co. Bags versus bugs. Resinous Reptr. 8, no. 1:12-14(Jan., 1947); B.I.P.C. 17:441.

The problem of insuring the original purity of crushed or cubed ice is now being solved by the use of disposable, multiwall, wet-strength paper bags. Uformite 467 or 470, a urea-formaldehyde resin, is added, preferably at the beater, to make the paper for these bags. The tensile strength and bursting resistance of the wet sheet are approximately 40% of the dry values; in untreated paper, the corresponding figure is 5-10%. Wet-tear strength is increased and folding endurance is improved by the addition of the resin. When kraft pulp is used and alum is added to lower the pH to 4.0-4.9, the following additions are suggested: 2-3% Uformite 467, aluminum sulfate to pH 4.0-4.9, and rosin as the paper manufacturer specifies.

327. Riddell, G. L. Science and packaging. Chemistry & Industry 66, no. 3:35-9(Jan. 18, 1947); B.I.P.C. 17:435.

The author reviews scientific developments in the packaging field, restricting his discussion to containers in which paper or flexible materials are the main constituents, such as paper bags and sacks, fiberboard containers, rigid and folding boxes, and composite containers. After enumerating the essential functions of a package, recent developments in packaging materials (coatings, laminations, transparent wrappings, strip coatings), strength of containers, water-vapor permeability, gas permeability, liquid penetration, molds and bacteria, and protection against insects are discussed.

328. Ried, J. Waterproofed paper. U. S. patent 1,667,691(April 24, 1928); C.A. 22:2057.

In forming material suitable for waterproof bags, the surface layer of paper is infused with bituminous material having a melting point above 120°C. by passing it through a bath of the molten material repeatedly and while the latter cools until viscous; the sheet is removed before it is completely saturated with the bituminous material.

329. Ritter, Ludwig. Impregnating compositions for preserving fibrous vegetable materials such as jute bags, wood or plants from microörganisma, fungi or insects. U. S. patent 2,310,257(Feb. 9, 1943); C.A. 37:4260.

An aqueous solution is used containing at least one of the compounds copper fluoride, arsenite and arsenate, together with ammonia and a hydroxy amine, such as triethanolamine, of low volatility and having a marked stabilizing effect on copper-ammonia compounds in dilute aqueous solutions and improving the impregnating and wetting properties of the solutions, and a mordant mixture of phthalic acid and naphthol compounds such as phenolphthalein and β-naphthol.

330. Rodenhäuser, H. Modern testing apparatus for packaging materials. Plastverarbeiter 7, no. 8:311-14(1956); Brit. Plastics Federation Abstr. 11, no. 12:955(Dec., 1956); Packaging Abstr. 14:110.

Some of the testing machines for packaging film are described with illustrations. These include strength and hardness testing machines.

331. Rogers, C., Meyer, J. A., Stannett, V., and Szwarc, M. Studies in the gas and vapor permeability of plastic films and coated papers. 1. Determination of the permeability constant. Tappi 39, no. 11:737-41(Nov., 1956); Packaging Abstr. 14:110; B.I.P.C. 27:332.

The transmission of gases through polymer films and resin-treated papers is carried out in a high-vacuum apparatus which consists of a gas supply, a stainless steel cell holding the film or paper sheet in a fixed position, and a McLeod gage used for measuring the increase in pressure. Before starting a measurement, the membrane is completely degassed by pumping down to a pressure of $10^{-5}$ mm. of mercury. The time for degassing depends upon the nature of the membrane. A supply of gas, near or below atmospheric pressure, is then admitted to the top of the cell and the final supply pressure measured by means of a manometer. The gradual increase in pressure on the low-pressure side of the cell is measured at appropriate time intervals by means of a McLeod gage. After the steady state has been reached, the permeability constant can be calculated.

332. Rogers, C., Meyer, J. A., Stannett, V., and Szwarc, M. Studies in the gas and vapor permeability of plastic films and coated papers. 2. Some factors affecting the permeability constant. Tappi 39, no. 11:741-7(Nov., 1956); Packaging Abstr. 14:110; B.I.P.C. 27:333.

The theory of gas and vapor permeability through plastic films is discussed, and the permeability shown to be the product of the solubility coefficient and the diffusion constant. The influence of temperature and pressure on the permeability constant is discussed, together with a number of molecular structural factors. The discussion is illustrated with practical data. Finally, a simple relationship is shown to exist between the permeability constants for a number of gases through two polymer films or for two gases through a number of polymer films.

333. Rogers, C. E., Stannett, Vivian, and Szwarc, Michael. Permeability valves; permeability of gases and vapors through composite membranes. Ind. Eng. Chem. 49, no. 11:1933-6(Nov., 1957); B.I.P.C. 28:806.

Film systems exhibiting different permeabilities in different flow directions may be used as "valves" in special applications. Such systems are described, and the conditions for their operation are discussed. The permeability of gases and vapors (expecially water vapor) through membranes composed of layers of different polymer films (especially Nylon 6 and Ethocell 610) was measured. The transmission of water vapor through single films is pressure dependent. Experimental data were used to calculate the theoretical transmission through two films in series.

334. Ross, William H., Adams, J. Richard, Yee, J. Y., and Whittaker, Colin W. Preparation of ammonium nitrate for fertilizer use. U. S. Dept. Agr., Tech. Bull. no. 912. June, 1946. 80 p.; Ind. Eng. Chem. 36, no. 12:1088-95(Dec., 1944); B.I.P.C. 15:172.

The properties of ammonium nitrate were studied in large-scale storage tests in different parts of the country. The results indicate that the material can be stored in a satisfactory form for direct use as a fertilizer by granulating it to give particles in the neighborhood of 8-16 mesh, drying to a moisture content of 0.2% or less, treating with a suitable conditioning agent, and storing in bags that are sufficiently moistureproof to keep the material dry throughout the storage period. The most suitable bags were found to be multiwall paper bags with two asphalt-laminated layers, built up from the inside out in the following way: one wall of 25-25-25 lb. asphalt-laminated paper, two walls of 50 lb. natural kraft, one wall of 25-25-25 lb.

asphalt-laminated paper, one wall of 70 lb. low stretch crepe, both ends wax dipped, waterproof glue throughout, and tuck-in sleeve of asphalt-laminated paper. Burlap bags having pleated paper linings and wire ties as closure were found unsuitable. The multiwall bags are capable of maintaining properly conditioned ammonium nitrate in a satisfactory mechanical condition for at least a year in the most humid sections in the country.

335. Ross, William H., and Yee, J. Y. The roll played by bags in the storage of ammonium nitrate. Am. Fertilizer 102, no. 7:7-10, 24, 26, 28, 30(1945); C.A. 39:3108.

Burlap and multiwall paper bags with two asphalt layers are at least twice as resistant to water vapor as the corresponding bags with one asphalt layer. A modified laboratory water-vapor permeability cell was developed for determining the relative permeability of the walls of bags to water-vapor transmission. A method is described for comparing the quality of different bags by photographing light transmitted through them. The extent to which conditioned ammonium nitrate undergoes caking in storage depends in large measure on the permeability to water vapor of the bags in which it is stored. The resistance of asphalt-laminated paper bags to water vapor is impaired by rough handling and by filling them with material at too high a temperature. The tendency of ammonium nitrate to cake in storage is increased by filling the bags too full and by use of bags of unusually stiff walls. The use of wire ties for bags is not so satisfactory for ammonium nitrate storage as valve or sewn closures. The steps that have to be taken in preparing ammonium nitrate for successful storage in humid sections of the country consist in drying and cooling the material to a temperature of about 40°C., or below, treating it with 3-4% of a suitable conditioning agent, and storing in bags that are sufficiently moisture-resistant to keep the material dry throughout the period of storage. Bags that will comply with this specification are now available at a relatively low cost.

336. Roth, W. Bag papers. Papierfabr. 23:529-31(1925); C.A. 20:288.

An experimental investigation of bag papers showed that paper made from soda pulp is preferable for filling with hot material, such as cement, etc., because of its ability to regain moisture and strength. The more viscous a pulp stock becomes, the less permeable is the resulting paper to air and the less suitable for bag paper. Paper having a tearing length over 5000 m. and a stretch over 3% is unsuitable for bag manufacture. The air number is defined as the time required for 1 l. air under a certain pressure to pass through a certain area of paper, and is a test used in evaluating papers made from soda and sulfite pulps for bag manufacture.

337. Rowe, W. W. Composite fabrics including paper and rubber. U. S. patent 2,101,874(Dec. 14, 1937); C.A. 32:1139.

A composite fabric suitable for making heavy duty bags, etc., comprises at least two layers of paper between which are cementitious layers including a layer of rubber deposited from latex and at least one layer of bituminous material between a paper face and the rubber layer.

338. Rowe, W. W. Composite sheet material suitable for bags, wall coverings, etc. U. S. patent 2,085,473(June 29, 1937); C.A. 31:5907.

A body substance such as a layer of cloth is cemented, by means of a bituminous adhesive, between layers of creped paper, one of which is treated with a sizing which renders it impervious to bitumen.

339. Rowe, W. W. Creped sheet material suitable for covering walls, making bags, etc. U. S. patent 2,198,392(April 23, 1940); C.A. 34:5576.

A nonfibrous film of material such as a cellulose derivative composition having a substantial expansibility given it by creped crinkles is united to a backing web of material such as cloth or paper by an intervening continuous layer of an adhesive material such as asphalt.

340. Rowe, William W. Method of making waterproof and moisture-vapor-proof packages. U. S. patent 2,476,325(July 19, 1949); B.I.P. C. 19:898; Packaging Abstr. 6:743.

A package is provided which protects its contents from water upon submersion, even at considerable pressures; it also has high resistance to the passage of moisture-vapor through the body material, seams, and closure. The package is essentially a bag made from paper creped by the positive adhesive action of a suitable binder such as bitumen or some other thermoplastic or adhesive substance.

341. Royen, A. H. H. van. Testing standards for bag paper. Papierwereld 11, no. 1:7-10(Aug., 1956); B.I.P.C. 27:333; Packaging Abstr. 14:359.

The author discusses various test methods and test criteria and their relation to the practical requirements posed upon paper bags.

342. Sabbioni, F. Gas and liquid permeability of films of plastic material. Chimica e industria (Milan) 38:1052(1956); Rubber Abstr. 35, no. 3:120(March, 1957); Packaging Abstr. 14:473.

The author describes methods and apparatus employed and results obtained in permeability tests with high and low pressure polyethylene films (Fertene and Rotene). In Rotene the higher crystallinity greatly reduces the coefficient of permeability.

343. Sachsenberg, E. Investigations of paper bags with regard to moisture permeability and strength. Papier-Ztg. 62, no. 84:1428-9; no. 85:1444-6(Oct. 20, 23, 1937); B.I.P.C. 8:175; 14:19.

Eight different kinds of multiwall bags for shipping hygroscopic fertilizers were tested with regard to moisture permeability and strength properties. The testing instruments and procedures are described in detail. It was found that bags with aluminum foil layers are far more resistant to moisture than the best bitumenized bags; bags whose long side was cut in the cross and not in the machine direction were found to be far more resistant to bursting experiments.

344. St. Regis completes new bag research and development lab. Paper Trade J. 137, no. 20:63-4, 66(Nov. 13, 1953); Paper Mill News 76, no. 48:5 (Nov. 28, 1953); Paper Ind. 35, no. 9:1019-20(Dec., 1953); Southern Pulp Paper Mfr. 16, no. 12:30, 32, 34(Dec., 1953); B.I.P.C. 24:280; Packaging Abstr. 11:167.

The facilities of the new laboratory devoted to multiwall bag research and development at Pensacola, Fla. are described. The new laboratory consists of a conversion-material, chemical, and bag-testing section, and a high humidity room. A special room contains the mechanical equipment which serves the laboratory installations.

345. St. Regis Paper Co. Multiwall flour bag is pyrenone treated. Packaging Parade 17, no. 201:63(Oct., 1949); B.I.P.C. 20:174; Packaging Abstr. 7:49.

A multiwall paper bag, the outer wall of which is treated with pyrenone, affords perfect protection against insect infestation and contamination of its contents. Under ordinary conditions flour can be shipped safely in untreated multiwall bags, but where severe shipping hazards are encountered, the treated bags are desirable. In a test shipment of flour in treated bags on which 4000 live red rust beetles were scattered, no beetles penetrated the pyrenone-treated sheet to reach the flour, 2361 were dead, and 287 were in a coma or paralyzed after 70 hours.

346. St. Regis Paper Co. New system for packing citrus fruits uses special chemically treated multiwall bag. Packaging Parade 16, no. 186:38 (July, 1948); B.I.P.C. 19:45; Packaging Abstr. 5:411.

A new system for the commercial packing of citrus fruit effects a reduction in packaging costs and fruit spoilage and shrinkage, and permits easier handling. The new Citrobag is used with a mechanical packer, which is described and illustrated. The inner wall of the Citrobag is chemically treated kraft paper; the two outer walls are of wet-strength paper treated with a compound which resists the effect of citrus juices. Tests show that Citrobag-packed oranges lose 2.45% by shrinkage in two weeks; those packed in containers where the air has access to the fruit lose 7.48%. The use of the new container eliminates the need for plant and transit refrigeration, assures sanitary packaging, and speeds packaging. Approximately $175 is saved per car of fruit when the automatic packer and the new bag are used.

347. St. Regis Paper Co. Polyethylene on paper. Modern Plastics 28, no. 4:67-71(Dec., 1950); B.I.P.C. 21:329.

The extrusion process used by the St. Regis Paper Co. for applying polyethylene to paper is described. Data are included on moisture-vapor permeability tests and comparison strength tests of polyethylene-coated bags.

Some of the properties and uses of Plyolene bags are reviewed, and a brief discussion is given concerning the favorable economic outlook for polyethylene-coated papers.

348. Salisbury, G. D. Paper control laboratory. Modern Packaging 22, no. 8:138-40(April, 1949); Packaging Abstr. 6:416.

The testing of paper used for bagmaking and the tests performed on filled bags at the recently opened Paper Control Laboratory at the Bemis Bro. Bag Co., are described.

349. Schaschek, H. Mechanism of water-vapor movement in porous sheet materials. Chem.-Ing.-Tech. 28, no. 11:698-702(Nov., 1956); B.I.P.C. 27: 430; Packaging Abstr. 14:360.

In an earlier paper by W. Vollmer, it was ascertained that the transport of water vapor through paper and some foils was principally due to surface diffusion. This work has been extended in the present investigation to show that the water-vapor permeability of papers can be treated quantitatively and that it lends itself to precalculation. The temperature dependence of surface diffusion has been measured, and the results are discussed with the objective of achieving a closer examination of the mechanism of water-vapor movement. Certain peculiarities of water-vapor diffusion through plastic films are indicated.

350. Schmidt, Werner. Experiments for evaluating the suitability of paper for ordinary and merchandise envelopes. A suggestion for supplementing existing testing procedures and standards. Wochbl. Papierfabr. 73, no. 15: 247-52(Aug. 8, 1942); B.I.P.C. 13:239.

The admixture of larger quantities of groundwood pulps or fillers to the furnish of cheap envelopes resulted in a number of complaints about their tearing and bursting along the edges, particularly on extended trips. Difficulties during conversion of the paper were also encountered. The original testing methods employed by the Materialprüfungsamt (MPA) for the evaluation of envelope paper were first limited to breaking length and folding endurance and were later supplemented by bursting strength tests on the flat and then creased paper, the test being carried out across the crease. It was also found that, by tumbling the mail in the revolving drum, the stresses to which the envelopes are subjected during shipment can be successfully duplicated. The MPA concluded that a reliable relationship existed between folding endurance and bursting strength, established critical lower limits on the basis of either test, and standardized them as tentative prodedures. The results were checked by Brecht in Darmstadt, who found that a definite relationship existed between the two tests only within certain limits. At higher basis weights, the relation between burst and fold becomes less evident as the percentage of short-fibered pulps in the furnish is increased. The folding endurance gives a better evaluation of the higher quality papers; the burst across the fold is more suitable for the lower grades. Both test results are only in limited agreement with the results of the revolving drum. In the opinion of both the MPA and Darmstadt, the lack of a suitable instrument for making the crease under identical, reproducible conditions was a handicap in the application of the bursting test across the crease. An instrument for this purpose is described in the present article. A paper strip approximately 15 cm. wide is fastened in the form of a loop. An iron roll weighing about 16 kg. always under identical pressure is passed over the loop and produces a fold at an angle of 180°. Tabulated data of two series of experiments with the bursting strength in the machine and cross direction of noncreased and creased paper of two furnishes ($C_1$ with 50% sulfite, $C_2$ with 20% sulfite) and in a number of basis weights are given. They indicate that the bursting strength of the noncreased paper of $C_1$ increases almost in direct ratio to basis weight, much less in the case of $C_2$. In the case of the creased paper, the increase in bursting strength is much less than the corresponding increase in basis weight, particularly in the cross direction of the paper, $C_1$ giving again higher values than $C_2$. Therefore, it is often more economical to employ a thinner paper with a higher sulfite content than a thicker paper with a large groundwood percentage. Another observation of importance made during these experiments is the influence of the moisture content of the air on the strength of the creased paper. The bursting strength of noncreased paper remains approximately the same when the moisture decreases from 80 to 40%—namely, from 1.63 kg. to 1.59 kg. The bursting strength of the creased paper, on the other hand, will be weakened from 1.28 kg./sq. cm. at 80% to 0.8 kg. at 40% moisture. An envelope manufactured in dry working rooms—for instance, during the winter months—reaches the consumer with a decrease in strength of more than one-third along the creases. Hence, the conditions under which the creasing procedures during envelope manufacture are carried out are nearly as important as furnish and quality of the paper. The author recommends the development of a standard testing procedure based upon the bursting strength of paper creased with a standardized instrument.

351. Schricker, Gerhard. Investigations on the measuring technique for resistance to splitting of cellophane heat-sealed seams. Verpackungs Rundschau no. 6:Suppl. 33-6(June, 1955); B.I.P.C. 26:298; Packaging Abstr. 12:892.

Since special instruments for the purpose are not available, a tensile tester type 645 of Firma Karl Frank GmbH. was adapted for measuring the strength of heat-sealed seams of lacquered cellophane films. Nonlacquered films accept ink, whereas lacquered films do not. A simple method for indicating whether a seam splits between the lacquered surfaces or between one of the base films and the coating consists in dipping the split seam portions into ink; color is only accepted by those portions of the cellophane from which the lacquer has been torn off during the splitting test. The width of the seams (provided it did not fall below 5 mm.) did not affect the testing results, whereas the application of the seam in the machine or cross-machine direction of the film, the rate of speed of the lower clamp of the tensile tester, and the moisture of the air to which the heat-sealed samples were exposed prior to testing exerted a considerable influence. Therefore in listing average results, data on these variables, as well as on sealing temperature and pressure, should always be included. Seams applied parallel to the machine direction of the film as a rule resist splitting much better than those prepared in the cross-machine direction; the only exception is polyethylene-coated cellophane, the seams of which do not show any difference in either direction. No explanation for this occurrence can be given. The best speed of the lower clamp in the present experiments was found to be 100 mm./minute. The importance of correct conditioning of cellophane films during storage, testing, and conversion is emphasized. Very dry or very moist goods packaged in heat-sealed cellophane bags may adversely affect the splitting resistance of the seams.

352. Schrüfer, W. Determination of gas permeability of plastic film. Kunststoffe 46:143-7(1956); Rubber Abstr. 34, no. 7:297(July, 1956); Packaging Abstr. 13:735; J. Appl. Chem. (London) 6, no. 7:ii-81(July, 1956).

Gas permeability is measured by means of instruments in which a capillary mercury column is moved through variations of pressure or volume. Sensitivity, accuracy, and lower limit are expressed as functions of pressure, temperature, and volume of the gas and as functions of the variability and accuracy of reading these. The accuracy of three instruments of different sizes was determined by experiment and was found to agree within narrow limits with the calculated accuracy. The importance of measuring volume suggests dimensions for an instrument for testing films of low permeability; this instrument is to be described in a further article.

353. Schrüfer, W. Determination of gas permeability of plastic films. Kunststoffe 46, no. 6:270-3(June, 1956); Rubber Abstr. 34, no. 8:352(Aug., 1956); Packaging Abstr. 13:824.

A new method and apparatus is described, in detail, with illustrations and mathematical basis. The film under investigation is supported between an evacuated chamber and a supply of gas via a measuring capillary. It is claimed that great accuracy is obtainable.

354. Schrüfer, W. Properties and potential uses of bags. Verpackungs Rundschau 8, no. 2:Suppl. 14-16; no. 3:Suppl. 22-4(Feb., March, 1957); B.I.P.C. 27:977; Packaging Abstr. 14:489.

After a discussion of the characteristics required in bag materials, the most important types of bags and their advantages and limitations are elucidated. Properties to be considered in the application of bags include their mechanical strength, quality and impermeability of the closure, liquid and gas permeability of the complete bag (especially seams and pores), and the type of goods packaged.

355. Schrüfer, W., and Schricker, G. A method for determining the gas permeability of plastic bags for vacuum and gas packaging. Verpackungs Rundschau 7, no. 9:Suppl. 69-72(Sept., 1956); B.I.P.C. 27:690; Packaging Abstr. 13:1052.

The gas permeability (I) of plastic bags is decisive in their applicability in vacuum and gas packaging. A simple nondestructive procedure for determining (I) is based on the measurement of the pressure increase in evacuated bags filled with a suitable material having a large void or pore volume; the bags are placed in a desiccator containing the test gas at approximately 1 atm. pressure, and the pressure increase inside the evacuated bag is read from a manometer scale connected to the desiccator by a three-way stopcock. Examples and calculations are given.

356. Schwab, A. W., Falkenburg, L. B., and Cowan, J. S. Simplified WVP test of papers and films. Modern Packaging 18, no. 12:141-3(Aug., 1945); B.I.P.C. 16:104; C.A. 39:5075.

A modified method for determining the water-vapor permeability of coated papers or films at 100°F. and 95% relative humidity is described; it is essentially a combination of the best features of a number of previously published methods. It involves sealing the film or paper with wax to a Petri dish containing calcium chloride; placing the dish at 100°F. over saturated potassium sulfate, and determining the water-vapor transfer by the gain in weight of the test assembly. The equipment employed is available in most chemical laboratories; as many as twelve Petri dishes may be placed in one desiccator, if four tiers are made by separating the desiccator plates with small wooden blocks. The position of the cell in the desiccator and induced air circulation as compared with ordinary diffusion, did not affect the results. A comparison with the Southwick method showed values which are from 60-100% greater for the modified method, but the order of water-vapor permeability is the same for both.

357. Scopp, Howard A., and Evans, Charles P. Color comparator for determination of water in cellophane. Anal. Chem. 28, no. 1:143-4(Jan., 1956); Packaging Abstr. 13:190; B.I.P.C. 26:440.

An accurate and rapid procedure for determining water in cellophane is described; it employs the Karl Fischer titration method and a color comparator for determining the end point with an accuracy equal to that obtained with an electronic titration.

358. Scott, W. E. Heavy duty multi-wall bags. Packaging Catalog, 1943:152, 154; B.I.P.C. 14:19.

Heavy duty multiwall paper bags are constructed of from three to six walls of kraft paper, depending upon the weight, density, and physical characteristics of the product they are intended to carry. Each ply or wall of paper is properly arranged in tubular form, one within the other, so that each bears its share of the weight. Greater flexibility and strength are obtained by using a multiple number of walls in relatively light basis weights rather than fewer walls of heavier paper. Sheets in the 40-50-lb. basis weights are most frequently employed. The two types mostly in use are the valve bag which is factory closed, and the open mouth bag, the closure of which is made either by sewing or pasting. For making bags water repellent, one or more walls of moisture-resistant sheets are incorporated in the structure; for direct protection against water, a special sheet is used as the outside wall. Sometimes the sewn bottom seams are wax-dipped for extra protection. This type of bag is ordinarily used for bulk shipping of commodities which are dry, powdered, or granular in character; the bags are now used also for materials which are poured in a liquid state and at high temperatures into the containers and, because of their post-hardening characteristics, become solid on cooling. Rosin and certain asphalts fall into this class.

359. Scribner, B. W. Improving peacetime packages. Domestic Commerce 34, no. 6:14-16(June, 1946); B.I.P.C. 17:80; Packaging Abstr. 4:73.

A number of developments are described which were the outcome of the stringent requirements for wartime packages and the necessity of conserving critical materials. Many of these developments were so successful that they will be carried into peacetime activities. The author summarizes the research work carried out in the Paper Section of the National Bureau of Standards, covering the construction of five types of sacks with four kinds of paper and the issuance of a Federal specification for sacks; the use of cellophane of the waterproof type for wrapping cigarettes; asphalted wrappings; studies with case liners and the different testing procedures involved; shipping tags made from wet-strength paper without metal eyelets, the latter being replaced by a hard-fiber paper patch; and the development of a tape with a water-resistant adhesive.

360. Seiberlich, J. Waterproof paper bags. Paper Trade J. 107, no. 3:41-2(July 21, 1938); B.I.P.C. 8:485.

The author recommends the use of a wax coating, which may be mixed with natural or artificial resins or other nonvolatile organic substances, for producing waterproof paper bags. A very uniform coat is essential; an apparatus for producing such a film is described briefly and illustrated by a schematic diagram.

361. Seith, Robert T. Glass-reinforced paper. Modern Packaging 28, no. 1:149-52, 234, 236(Sept., 1954); B.I.P.C. 25:132.

Reinforcement of paper with a nonwoven glass-fiber mesh or scrim, introduced onto a paper machine prior to the formation of the sheet, results in a substantial increase in physical properties over the common laminated paper structures. Exhaustive tests have indicated that this paper, designated as Scrimtex, remains flexible and strong at temperatures as low as —80°F., and that temperatures up to 425° have been used in packaging molten materials without difficulty. Data are given comparing packaging papers, bags, and board made of Scrimtex with other constructions in physical characteristics (basis weight, burst, tear, and puncture), drop tests, field shipments, and cost. Primary applications within the packaging field include multiwall and single-ply bags, solid-fiber and corrugated shipping containers, expendable pallets, tarpaulins and case liners, and special industrial applications, such as grain doors.

362. Seith, Robert T. Testing multiwall bags at low temperatures. Low Temperature Test Methods and Standards for Containers--a Symposium: 93-7; discussion: 98-9 (Sept., 1954); B.I.P.C. 25:563; Packaging Abstr. 12:621.

Experiments on the packaging of cement in multiwall bags for shipment to areas with extremely low temperature conditions are described. The Navy Specification calls for a five-ply inner bag with one waterproof ply and a five-ply overslip with two waterproof plies and waterproof ends. In an attempt to give additional strength with fewer plies, tests were made using Scrimtex, a paper reinforced with a Fiberglas scrim. These test results show that an improved bag with a smaller number of plies and lighter weight, which will be satisfactory under Arctic conditions, has been obtained.

363. Shaĭdyuk, V. K. Change in properties of plugging cement as affected by storage. Tsement 17, no. 4:22 (1951); C.A. 46:2773.

Ten days after grinding, samples of cement were taken from the silo and stored in (1) an ordinary paper bag, (2) a bituminized paper bag, and (3) open. From these cements, samples were taken periodically for 1-4 months and tested. Generally, under the influence of water vapors and carbon dioxide in the air the cement underwent partial hydration and carbonation with subsequent change in properties. The cement was best preserved in the special bag.

364. Sherman, Clayton C. Stretchable paper. U. S. patent 2,169,505 (Aug. 15, 1939); C.A. 33:9644.

Apparatus is described, and a method given for setting the corrugations of a longitudinally corrugated web which comprises, passing a corrugated web forwardly in a direction parallel to said corrugations, and ironing the corrugations to a plane intermediate the planes of the crests of said longitudinal corrugations at areas spaced longitudinally along each of the corrugations. Material thus prepared is suitable for lining bags or barrels.

365. Sherman Paper Products Corp. "Multiflex" by Sherman. Paper Trade J. 132, no. 10:12 (March 9, 1951); Modern Packaging 24, no. 8:198 (April, 1951); B.I.P.C. 21:570.

Reference is made to a new wrapping material involving a flysheet of kraft between the corrugated flutes of the kraft Corroflex and the crepe backing; the latter is edge glued to the Corroflex. The flysheet allows the wrap to shift slightly with impacts, thereby turning the force of the shock. Since the introduction of "Multiflex" in the automotive field, successful results in lowered shipping damage and reduced costs have been reported.

366. Sherman Paper Products Corp. New accordion pleated paper bag. Packaging Parade 16, no. 191:75 (Dec., 1948); B.I.P.C. 19:336.

An improved accordion-pleated machine-made paper bag, now available, can be stored compactly when folded, opened easily, and used for a variety of products, such as furniture and major appliances. An air vent in each corner of the bag permits pocketed air to escape without affecting its dustproof qualities. The bag is made of various kraft papers, including creped, waterproofed, and jute-reinforced.

367. Shold, K. M. Seam adhesives for multiwall bags. Tappi 34, no. 7:294-6(July, 1951); B.I.P.C. 21:833; Packaging Abstr. 8:713.

The successful manufacture of multiwall bags is dependent to a large extent on the use of proper seam adhesives. These seam adhesives fall into three main classifications: (1) standard seam adhesives, (2) water-resistant seam adhesives, and (3) waterproof seam adhesives. The selection of the best adhesive for each classification involves consideration of physical, chemical, and psychological factors. The choice of a particular adhesive for each classification is often limited by the type of paper involved and by the effect of heat on the adhesive bond.

368. Should we standardise paper bags? Paper Box Bag Maker 102, no. 3:85(Sept., 1936); B.I.P.C. 17:262; Packaging Abstr. 4:26.

The suggestion is made that a "Standards Council" be set up for testing bag paper for tearing, tensile, and bursting strengths; according to the figures for each test, limits of size and volume for the bags to be produced from the paper should be set. The completed bag should then have to undergo a further bursting test, thereby arriving at a standard of paste or glue in use. Carrier bags would have to come up to standard for string and board. Similar to the system already in use among manufacturers of fiberboard containers, the testing results and capacities would have to be printed upon the bags. The suggestion was prompted because of the poor performance of many present-day paper bags in England, most of which are made with a large percentage of waste paper.

369. Shuman, A. Cornwell. Apparatus for measuring the gas permeability of film materials of low permeability. Ind Eng. Chem., Anal. Ed. 16, no. 1:58-60(Jan., 1944); B.I.P.C. 15:24.

An apparatus is described for measuring the gas permeability of film materials having permeabilities as low as 0.001 cc. (at standard temperature and pressure) per 100 square inches per 24 hours. The low range for previously reported methods (water vapor permeability and balloon fabric permeability) is about 100 cc. per 100 square inches per 24 hours. The apparatus combines simplicity of design and manipulation with high sensitivity in a unit which can be fabricated in most machine shops. The measurements are made under conditions of one atmosphere pressure differential. One illustration and two diagrams of the apparatus are included.

370. Sieberlich, J. Waterproof paper bags. Paper Trade J. 107, no. 3:41-2(1938); C.A. 32:8141.

Paper bags are waterproofed by coating with a very thin film of wax (suitably a mixture of carnauba wax 20, ceresin 5, petrolatum 10, rosin 5) by means of a specially designed brush coater, which is described.

371. Significant tests for plastic films. Can. Chem. Processing 38, no. 10:111(1954); Brit. Plastics Federation Abstr. 9, no. 12:1248(Dec., 1954); Packaging Abstr. 12:164.

The properties of a number of plastic films were determined by uniform methods so that they could be compared. Permeability figures for these are tabulated.

372. Skidmore, E. A. X-crepe, how it's made and used. Modern Packaging 17, no. 7:118-23, 226(March, 1944); B.I.P.C. 14:287.

The author describes the process known as asphaltic X-creping which produces lines of creping on both diagonals of a sheet which cross in the form of an "X". The first step is to coat the plain uncreped paper with a uniform layer of a special high-grade asphaltic compound; this provides an unbroken waterproof film. The coated sheet of paper is then cemented to a large creping cylinder, the asphalt acting as the adhesive. The creping blade, instead of being placed parallel to the axis of the cylinder as in the ordinary case, is placed diagonally at 45° angle across the face of the creping drum. As the cylinder rotates, the creping blade removes the paper and asphalt conjointly from the cylinder and imparts lines of crepe which are, in effect, a series of small pleats in one diagonal, shrinking the sheet both longitudinally and laterally. The web is then carried to a second creping cylinder and cemented to it, the creping blade operating in the identical manner, but this time in the opposite direction. A sheet with a high degree of stretchability in both directions results. Two sheets of X-creped paper are then combined, with the asphalt surfaces together, to form a duplex sheet, or one or more plies may be added to give additional strength. The sheet is highly impervious to the passage of water or moisture vapor through the plies; a protective all-over antiwick impregnation is applied along the cut edges to prevent water or moisture from wicking along the paper fibers in the seam areas. The characteristics, prewar uses, and present applications of asphaltic X-crepe are discussed, one of the most important uses being a vapor-moistureproof, submersible bag. Adhesives and sealing procedures are outlined, and the results of moisture-vapor and submersion tests described. Brief reference is made to postwar applications. Illustrations are included.

373. Slide rule facilitates selection of multiwall bag papers. Chem. Processing 20, no. 3:135(March, 1957); B.I.P.C. 27:854.

A slide-rule paper selector for multi-ply paper bags, issued by St. Regis Paper Co., New York, gives properties, construction, and packaging applications of papers providing protection against grease, oil, acid, alkali, abrasion, bacteria, insects, and moisture and water damage.

374. Slone, Murray C., and Reinhart, Frank W. Properties of plastics films. Modern Plastics 31, no. 10:203-4, 206, 208, 212, 215-16, 218, 223-4, 226, 380(June, 1954); Packaging Parade 22, no. 258:22-3, 57(July, 1954); B.I.P.C. 24:911; Packaging Abstr. 11:848.

The properties of 13 varieties of commercially available plastic films (cellophane, cellulose acetate, cellulose acetate butyrate, cellulose triacetate, ethylcellulose, polyethylene, polystyrene, polyester, saran, polyvinyl alcohol, polyvinyl chloride, polyvinyl chloride-saran laminate, and polymethyl methacrylate) in different thicknesses were measured. The results of tests to determine tensile strength, tear, folding endurance, water absorption, water-vapor permeability, low-temperature impact, change in linear dimensions on heating, specific gravity, and flammability properties are summarized. These results indicate the range of properties available for various types of films and the limitations of some of the test procedures commonly used; the system employed in sampling the specimens is outlined.

375. Some hints for paper bag makers. Paper Box Bag Maker 88, no. 4: 122(Oct. 10, 1939); B.I.P.C. 10:127.

Brief reference is made to the fact that simple testing machines, such as a Schopper strength tester, a tearing strength tester, and a bursting strength tester, are still missing in most bagmaking factories, and that too little information is given by the buyer with regard to use requirements of the bags. This results quite often in the incorrect selection of paper weights and grades, either too weak or too strong paper being chosen, which in both cases signifies a preventable waste.

376. Smallman, B. N. Residual insecticides for the control of spider beetles in cereal warehouses. J. Econ. Entomol. 41:869-74(1948); C.A. 51: 2729.

Ptinid beetles (chiefly Ptinus villiger) were controlled in warehouses by sprays of $\gamma$-benzene hexachloride (0.5% in oil solution) at 20 g./1000 sq. ft., which gave 76-96% reduction over controls. With DDT (5%) in oil at 204 g./1000 sq. ft. or in water suspension at 238 g., 99 and 94% reductions, respectively, were obtained. $\gamma$-Benzene hexachloride used as a smoke gave no significant protection. Aluminum oxide and magnesium oxide used as dusts gave 83 and 84% reduction, respectively. Cotton sacks impregnated with 2,2-bis(p-chlorophenyl)-1,1,-dichloroethane (120 mg./sq. ft.) and untreated paper sacks gave nearly complete protection to flour.

377. Smith, F. R., and Kleiber, Max. Apparatus for measuring rate of gas penetration through food-packaging materials. Ind. Eng. Chem., Anal. Ed. 16, no. 9:586-7(Sept., 1944); B.I.P.C. 15:62.

An apparatus is described for measuring the rate of gas penetration through flexible materials. It is particularly suitable for the rate of oxygen penetration into pouches used for food packaging. The absolute accuracy of the measurements is determined mainly by the accuracy of gas analysis. The relative accuracy can be changed by varying the time of penetration and thus the difference between start and end concentration of oxygen in the gas inside the pouch.

378. Southwick, C. A. Packaging testing procedures. Fibre Containers 29, no. 4:48(1944); Packaging Abstr. 1:231.

The "Manual of Testing Methods" to be produced by the (U.S.) Packaging Institute consists of (a) those borrowed from other technical bodies (e.g., TAPPI) and (b) those largely neglected before, viz.: (1) description of material testing conditions; (2) sample testing procedure; (3) determination of moisture; (4) basis weight of materials; (5) wet-tensile strength of materials. Subcommittees have been established to deal with (1) rigid metal packages and fiber cans; (2) glass containers; (3) folding and setup cartons; (4) bags, metal foils and converted materials; (5) shipping bags and outer containers; (6) transparent film and plastic materials; (7) paper-base materials; (8) lacquers, waxes, coatings, etc.; (9) machinery; (10) adhesives; and (11) packaged products.

379. Spengler, O., and Dörfeldt, W. Experiments on the storage of white sugar in valved paper sacks. Z. Wirtschaftsgruppe Zuckerind. 91:368-86(1941); Chem. Zentr. 1:939(1942); C.A. 37:3626.

Storage of white sugar in sacks of about 4.5 kg. capacity made of paper, with and without a bitumen protective layer, and provided with a special closure (valve), was compared with storage in jute sacks. The sacks with a bitumen layer were very much superior to regular jute sacks. The sacks without a bitumen layer were not quite satisfactory under the stringent conditions of the tests, but they were better than the jute sacks.

380. Spring, C. P. Flexible container's needs. Tappi 37, no. 12:132-3A(Dec., 1954).

The requirements for paper for making multiwall shipping sacks are outlined.

381. Srere, Alfred A. Liner coating composition. Canadian patent 498,018(Dec. 1, 1953); U. S. patent 2,413,007(Dec. 24, 1946); B.I.P.C. 24:490.

A composition for lining paper bags, paperboard cartons, etc., to prevent adhesion of synthetic rubber or like material to the package is made by mixing fine talc, kaolin, protein, caustic soda, plasticizer, and water and applying this material as a coating before forming the container.

382. Stamm, A. J. Diffusion in cellulosic materials. Australian Pulp & Paper Ind., Tech. Assoc. Proc. 10:244-67(1956); Packaging Abstr. 14:474.

The rates of liquid water absorption and swelling, and the rates of water vapor adsorption and swelling at 84% relative vapor pressure and at different temperatures were measured on uncoated regenerated cellulose film of two thicknesses. All of the data give linear property changes when plotted against the square root of time up to moisture contents which are two-thirds of the initial or final values. On the basis of the moisture distribution through the thickness of the film being parabolic, the break is shown to occur when moisture begins to be lost or gained from the center of the specimen. The squares of the slopes of the linear portions of the plots at different temperatures increase with the vapor pressure of water and approximately with the diffusion constant. Measurements were also made of the diffusion of water through regenerated cellulose film at two different temperatures by the steady-state cup method with various relative humidity boundary conditions and with internal stirring. Diffusion constants were calculated on the basis of linear vapor-pressure gradients and parabolic bound-water gradients, the latter being experimentally justified. The diffusion constants on both bases increase exponentially with an increase in the fractional water volume.

383. Stamm, Alfred J. Diffusion of water into uncoated cellophane. I. From rates of water vapor adsorption, and liquid water absorption. II. From steady-state diffusion measurements. J. Phys. Chem. 60, no. 1:76-86 (Jan., 1956); B.I.P.C. 26:449-50.

The rates of liquid water absorption and swelling and the rates of water vapor adsorption and swelling at 84% relative vapor pressure and different temperatures were measured on uncoated regenerated cellulose films of two thicknesses. All of the data give linear property changes when plotted against the square root of time up to two thirds of the final change. The square of the property changes/unit of time increases with an increase in temperature as the vapor pressure of water and approximately as the diffusion constant. Diffusion constants calculated by conventional methods, assuming the moisture gradient across the film to be parabolic, are in good agreement. The calculated activation energies are about equal to the heat of swelling plus the heat of condensation. The diffusion of both water vapor and liquid water into regenerated cellulose film can be considered a bound-water diffusion under a parabolic moisture gradient. The rate of diffusion at different temperatures is, however, controlled by the rate of molecular impact on the surface (i.e., the vapor pressure of the water). Measurements were made of the diffusion of water through uncoated regenerated cellulose sausage-casing films at two different temperatures by the steady-state cup method with various R.H. boundary conditions and with internal stirring. The need for internal stirring with permeable films is shown. Diffusion constants were calculated on the basis of linear vapor-pressure gradients and parabolic bound-water gradients, the latter being experimentally justified. The diffusion constants on both bases increase exponentially with an increase in the fractional water volume. The data indicate that the diffusion is controlled by vapor pressure.

384. Stannett, V., and Szwarc, M. The permeability of polymer films to gases—a single relationship. J. Polymer Sci. 16, no. 81:89-91(1955); Brit. Plastics Federation Abstr. 10, no. 5:387(May, 1955); Packaging Abstr. 12:620.

The permeability of a number of plastic films to the following gases was determined and the results are tabulated: oxygen, nitrogen, carbon dioxide, hydrogen sulfide.

385. Steenberg, Börje. Behaviour of paper under stress and strain. Pulp Paper Mag. Can. 50, no. 3:207-14, 220(Convention, 1949); B.I.P.C. 19:562.

By means of a series of new recording instruments the stress-strain behavior of paper has been studied under widely different conditions. The rate of strain has been varied by a factor of more than $10^6$. In the most rapid experiments, the paper breaks within a millisecond. The slowest experiment requires several days. The behavior of paper in rapid and slow straining processes is different and so are the changes brought about in the material by the straining processes. This is shown, for example, by comparison of stress-strain curves for paper strained twice, first slowly and then rapidly and vice versa. The ultimate tensile strength increases very markedly in the rapid experiments, but the relative increase is also a function of the fiber composition of the paper. Extensibility is not affected very much by the rate of straining. From the stress-strain curves several properties of the paper may be evaluated--e.g., the initial and ultimate modulus of elasticity and thixotropic changes brought about by repeated cycles of straining. The plastic properties of the material are given by tracing apparent viscosity curves. The practical value of such information for judging the properties of, for instance, flongs is discussed. Special attention is given to stress-relaxation of paper under constant deformation. This property may be very different for different papers. Some papers strained rapidly (0.001 sec.) will, while held under constant strain, relax extremely slowly and never completely. Others, strained to the same extent, will dissipate the energy completely in as short a time as 0.01 second. In this connection experiments have been conducted to study the effect of draws in the paper machine on this and other paper properties, as well as the influence of relative humidity. The importance of the capability of paper to dissipate energy without undue stresses being built up and the relation between this property and the ease of tearing is discussed--especially for newsprint and bag paper. When a paper bag drops to the floor, the kinetic energy is partly transformed into heat by friction between the particles filling the bag and is partly taken up by the paper. In the latter case some energy is dissipated as heat by irreversible stretch and some is stored as potential energy. Further studies on the energy distribution for different cases are required.

386. Stevens, Henry W. The functional bag and its postwar job. Modern Packaging 18, no. 9:118-20, 164(May, 1945); B.I.P.C. 15:380; Packaging Abstr. 1:498.

Changes in food products have created the demand for good, protective, yet inexpensive packages, particularly for concentrated foods in a dry form. Satisfactory paper packages have been developed as paper bags or bag-in-carton combinations; these will remain on the market only as long as their performance, cost, and acceptance justify their use. Dried whole milk has long been considered one of the most difficult products to pack, because it has a very delicate taste and off-flavors result where excessive oxidation takes place. It was previously considered necessary to exclude oxygen. Extensive tests have shown that a good paper moisture-vaporproof barrier offers adequate protection, and a lamination of three sheets of pliable glassine with an adhesive including microcrystalline wax was found satisfactory. After filling and sealing, these bags are inserted into a carton made from white patent-coated news. Duplex and single-wall bags are now used extensively by the frozen food industry, and run as large as the 50-lb. capacity for institutional uses. Duplex bags are lined with cellophane, wet-strength laminated glassine, and coated wet-strength papers; the same materials are employed for single wall bags used as carton liners for frozen foods. In protective shelf packages of duplex construction, the outer sheet, when possible, is made from bleached pulp to provide strength and printing surface, and the liner of the correct protective material, such as foils, cellophane, glassine, parchment, Pliofilm, or plastic films. Customer acceptance of the bag package is improving with the great advances made in protective materials during the war.

387. Stewart, Glenn. Vegetable parchments. Packaging Catalog, 1943: 330, 333; B.I.P.C. 14:19.

A brief description of the properties and special uses of genuine vegetable parchment is given, the latter including the wrapping of many foodstuffs and grease-packed metal items, greeting cards, lining of bags and fiber containers which replace tin, antitarnish wrapper for highly polished metal parts, etc.

388. Stowell, Finch. Background of use of multiwall bags by the Armed Forces. Low Temperature Test Methods and Standards for Containers--a Symposium: 92-3 (Sept., 1954); B.I.P.C. 25:564; Packaging Abstr. 12:622.

The problem of breaking of multiwall bags used in packaging cement for construction in the Aleutian Islands and other experiences where up to 80% of all cement shipped was lost as a result of ineffective packaging prompted specifications for the bag currently in use. The testing program is still underway, since the present bag is not fully satisfactory; at cold temperatures, asphaltic compounds fail and with polyethylene laminates, the paper ruptured.

389. Stretch cellophane to test moisture content. Paper, Film and Foil Converter 31, no. 1:29 (Jan., 1957); B.I.P.C. 27:548; Packaging Abstr. 14:273.

The American Viscose Corp. has developed a method and apparatus for determining the moisture loss or gain of cellophane during a manufacturing step (e.g., printing) by measuring the stretch of the cellophane before and after the processing step. The moisture content of cellophane is proportional to the amount of stretch measured.

390. Stretchable paper introduced by Westvaco. Modern Packaging 31, no. 6:197(Feb., 1958).

Kraftsman Clupak, the new product developed by Clupak Inc., has a built-in elasticity, up to 20%, and is designed to make it resilient to impact. The paper is immediately useful to packagers in the form of multiwall bags.

391. Supnik, R. H., and Adams, C. H. A ball-drop technique for estimating polyethylene film toughness. Plastics Technol. 2, no. 3:151-7(1956); Brit. Plastics Federation Abstr. 11, no. 6:470(June, 1956); Packaging Abstr. 13:646.

The development of the ball drop impact test for determining the strength of polyethylene film is discussed in detail with diagrams and illustrations of the machine used. The effect of many variables on the results is considered and shown graphically.

392. Surface bonding test for cellulosic films. Paper, Film and Foil Converter 30, no. 3:23(March, 1956); Packaging Abstr. 13:376.

The wax streak test for evaluating the anchorage of coatings or printing to the surface of regenerated cellulose film can be undertaken within 5 min. after the film leaves the dry end of the casting machine. This simple and rapid test is not meant to supplant more conventional methods. It was devised in the research laboratories of the American Cyanamid Co.

393. Synthetic rubber...big job for multiwall bags. Modern Packaging 18, no. 7:86-7, 142(March, 1945); B.I.P.C. 15:335.

After various experiments, the following multiwall bag has been adopted for the domestic shipment of synthetic rubber: a three-ply bag, composed of a 60-lb. base clay or talc coated sheet, a 50-lb. kraft paper, and an 80-lb. creped sheet. The rubber does not adhere to the coated paper sheet but strips clean from it. The rough surface of the creped outside sheet prevents the slipping of the bags when stacked. Moisture protection is no problem for domestic shipment; however, in the case of exports, a five-ply bag is used, one of the laminations being an asphalt-laminated sheet. The bags are closed by sewing or with a diamond fold and sealed with gummed tape.

394. Szhelyuk, S. P. Bursting strength of bag paper. Bumazh. Prom. 28, no. 6:14-17(June, 1953).

The equations given in the literature by Kendall, Bergman, and Dahlen for the conversion of breaking load to bursting strength do not apply in the case of bag paper. Also unfounded is the concept of the controlling effect of breaking load in the cross direction and of stretch during the bursting of bag paper. The bursting strength of paper is stated to be a function of the composite strength and uniformity of the sheet (in terms of its extensibility), as well as of other structural properties of the paper. Bursting strength does not reflect the ultimate performance of the paper bag.

The recommended method of rejecting the paper on the basis of a single index is expedient only because it simplifies the grading process. Satisfactory performance by paper bags is ensured at high breaking load in the cross direction, high extensibility, and also by the presence of a sufficiently great porosity. The breaking load in the machine direction has a lesser effect. The proposed formula for bursting strength is $P = \frac{P_c}{F+f}$, where $P$ is the specific pressure on the paper, $P_c$ is the total surface pressure, $F$ is the stretch and $f$ is the increment of surface due to stretch.

395. Tank-Nielsen, T. Evaluation of sack paper. Norsk Skogind. 9, no. 9:304-11(Sept., 1955); Paper Box Bag Maker, Oct., 1955:203-5; B.I.P.C. 26: 213; Packaging Abstr. 12:1019; 13:290.

Sugar shipments in 50-kg. multi-ply paper bags from different countries were checked upon arrival at Norwegian ports, the breakage figure (including all degrees of failure) varying from 1.55 to 4.89%. The survey revealed a preponderance of high breakage figures for shipments in certain vessels and of low figures for others; since paper analyses did not reveal the reasons for difference in service strength, it may be assumed that the conditions under which the ships were loaded are responsible. Rail or truck transports are usually less severe on paper sacks than overseas shipments. In addition to paper requirements many other causes may contribute to sack failure, such as improper number or nesting of the plies, loose glue seams, improper closure, unsuitable handling methods, the amount of free space in the sack, etc. The purpose of the present study was to find the reasons for performance variations in perfectly sewn or pasted valve bags with the proper weight of contents which could be traced to the quality of the paper delivered from an outside supplier to the converter. Existing standards and testing methods are reviewed and evaluated, including U. S., British, Scandinavian, and German specifications, with particular reference to the work by Burgstaller and Krauss; the correlation between recent testing methods and performance strength of the bags is discussed. Experience has shown that insufficient moisture content is one of the important causes for failure and that more attention should be paid to this factor by papermaker and converter. High breakage figures which appear unexpectedly can often be traced to low humidities, for instance in connection with extremely cold weather. Sack paper which has been dried to 98% dryness on the paper machine takes a much longer time to absorb moisture than a paper dried only to 94% dryness and may reach a lower moisture content even after days of conditioning. Sacks leaving the plant of the converter must have the correct moisture content in both outer and inner plies.

396. TAPPI. Specifications for rope paper for sacks. Special Report no. 44. New York, The Association, May 26, 1926. 8 p.

Specifications for the manufacture of paper sacks from manila rope and unbleached kraft pulp are given.

397. Tasker, C. W. Rupture tester. U. S. patent 2,748,596(June 5, 1956); B.I.P.C. 27:270; Packaging Abstr. 14:186.

A simple rupture tester, based on the free-falling weight method, is described, in which cellulose films and other sheet material are both preconditioned to the desired test temperature and subsequently tested for rupture resistance. The instrument operates over a wide range of temperature.

398. Tatebayashi, K. Water permeability of organic materials. III. The permeability of polyvinyl chloride. J. Soc. Rubber Ind. Japan 26:397-40 (1953); C.A. 49:7281; Packaging Abstr. 12:705.

With plasticized polyvinyl chloride sheet, the relation between water permeability and the following items was studied: (1) types of plasticizer; (2) amount of plasticizer; (3) thickness of the sheet; (4) molecular weight of the resin; (5) hardness; and (6) the flow temperature calculated from the relation between plasticity and temperature.

399. Teakle, L. J. H., and Hill, H. E. The rotting of superphosphate bags. J. Dept. Agr. W. Australia 20:138-41(1943); C.A. 38:203.

The excessive damage to superphosphate bags associated with superphosphate made from Egyptian rock is due to hydrochloric acid. Measures for reducing this damage are suggested.

400. Test films and packages in lab proving ground. Paper, Film and Foil Converter 30, no. 5:36-7(May, 1956); B.I.P.C. 26:839.

A series of photographs is presented to illustrate the various tests used on plastic packaging materials by the Bakelite Co. at its new Bound Brook, N. J. laboratory, including tests for transmission of a chemical through a polyethylene membrane, grease resistance, slippage of film on film, cracking characteristics, and treatment of film for printing.

401. The testing of paper bags; report of the testing station of the Natronzellstoff- und Papierfabriken AG., Oker/Harz. Allgem. Papier-Rundschau no. 21:898-901(Nov. 12, 1951); B.I.P.C. 22:351; Packaging Abstr. 9:20.

Following a brief discussion of the poor correlation of standard static paper-strength tests and the actual performance of paper bags, the methods and testers used for routine control by the above-mentioned mill are described; they include a table drop tester, a revolving drum, a shoulder throw-off tester (I), and a special bursting-strength tester (II). Wherever possible, the conditioned bags are tested with the contents which they are intended to carry; for certain fundamental studies, a mixture of sawdust and quartz sand is employed. Attention is paid to the fact that the degree of filling corresponds to that actually used in practice. (I) consists of a first horizontal, then ascending conveyor belt which carries the filled bag to a tripping board from where it drops from a height of 1.10 m. to the ground; the bags are placed on the conveyor with the seams and valves in different positions in a definite sequence. The height of the test results obtained with the first three instruments varies considerably; as a rule, the highest values are obtained with the drum tester, and the lowest with (I). In a series of experiments with pasted valve bags and sand filling, the ratio of the results of (I)--drop-table--revolving drum was: 1:3:7. (II) is used for testing unfilled open block-bottom bags. The bag is drawn over a rubber bladder which, in turn, is pulled over a metal canister; water is pumped between the canister and bladder until the expansion of the latter causes the bag to burst. This static bursting-strength test gives an indication of satisfactory bag conversion; with uniform pasting of all seams of multiwall bags, all layers will burst simultaneously, otherwise one after the other. Testing chambers for extreme (arctic and tropical) conditions and an instrument for simulating the impact of loaded railway cars are under construction.

402. Testing raw materials for box and bag making. Paper Container 62, no. 2:33, 35; no. 3:61, 63; no. 4:89, 91; no. 5:117, 119; no. 6:147; 63, no. 1:5; no. 2:37, 39; no. 3:67, 69; no. 4:95, 97; no. 5:123; no. 6:151, 153; 64, no. 1:5, 7; no. 2:37, 39; no. 3:65, 67; no. 4:93; no. 5:121, 123; no. 6:149, 151; 65, no. 1:5; no. 2:33, 35; no. 3:61, 63(Feb.-Dec., 1950, Jan.-Sept., 1951); Packaging Abstr. 8:788; B.I.P.C. 22:96.

Tensile strength, folding strength and opacity tests for paper are included, as well as tests for adhesives, cellulose films, and glues. Information on the evaluation of the tests is also provided.

403. Tests prove films don't stop insects. Food Field Reptr. 22, no. 23:36(Nov. 15, 1954); Packaging Abstr. 12:93.

Tests on 14 kinds of packaging films with 11 varieties of common insects were carried out at the Citrus Experiment Station of the University of California by P. L. Gerhardt and D. L. Lindgren. It was proved that cellulose film, no matter how thick, was easily penetrated and the resistance of polyethylene varied directly with film thickness. Of the transparent laminated films, a combination of saran and Pliofilm proved most resistant. Nontransparent laminated film containing aluminum foil is insect-resistant but not insect-proof.

404. They're in the bag, sliced, peeled and ready to cook. Packaging Parade 18, no. 208:40(May, 1950); B.I.P.C. 20:728.

A three-ply bag developed by Union Bag & Paper Corp. is being used by Colony Food Products, Medford, Mass., for packaging potatoes which have been peeled, sliced, and treated to retard discoloration. The bag consists of a parchment inner liner to provide wet-strength qualities and protect against foreign odors, a center ply of kraft paper laminated to asphalt to insulate against rapid temperature changes, and an outer layer of wet-strength kraft paper to provide high tensile and tear strengths.

405. This is packorama. Case no. 3...co-starring a trade-mark and multiwall bag. Packaging Parade 22, no. 256:14-15, 112-13(May, 1954); B.I.P.C. 24:831.

An elastic multiwall bag, made with five plies of kraft stock which are crinkled and laminated with a combination cold-weather adhesive and asphalt provide siftproof, insectproof, and waterproof protection for seed corn packaged by Funk Brothers Seed Co., Bloomington, Ill.

406. Throckmorton, Edgerton A. The latest developments in paper and fiberboard for packaging food. Proc. Inst. Food Tech.:121-5(1942); B.I.P.C. 13:371.

The author reviews briefly the various known methods of securing protection of foodstuffs with paper and paperboard, the most universal problem being the resistance to the transfer of vapors or gases. All the protective media are relative in their efficiency. Even the dense glassines and parchments are not particularly useful in this respect without other aids. Only the foils and rubber hydrochloride films are naturally vapor resistant in the food protection range. Cellophane derives its principal resistance from a lacquer coating. All paper-like materials may receive additional protection through either coatings, laminations, or combination packages. The problem of satisfactory bags lies in the efficiency of the bag assembly and the effectiveness of the seals to be obtained on a production basis. Sometimes excellent seals may be obtained in the laboratory, but it may be impossible to duplicate them in practical production with available equipment. In common with bags, wraps and cartons are no better than their production seals. Dipping operations have recently been adopted for several commercial products as well as by the army. In conclusion, fiber cans are discussed. A variety of linings, laminations and coatings, or floodings have been introduced with considerable success. The fiber can has the outstanding advantage of requiring comparatively little new handling equipment. However, new complications of end closures are involved in the elimination of metal tops and bottoms, and all types of packaging machinery are now difficult to obtain.

407. Thwing shopping bag tester. Paper Trade J. 103, no. 19:24(Nov. 24, 1936); B.I.P.C. 7:117.

The tester was developed for showing how much load can be applied to a bag before the handles pull out.

408. Tippmann, Paul. Paper bags and plastics. Neue Verpackung 9, no. 9:556(Sept., 1956); B.I.P.C. 27:845.

The advantages of plastics over bitumen for improving the resistance properties of paper bags are pointed out, and two ways in which plastics find use in paper-bag manufacture—plastic-film liners and plastic-coated paper liners—are discussed.

409. Todd, H. Russell. Apparatus for measuring gas transmission through sheets and films. Paper Trade J. 118, no. 10:32-5[T.S. 84-7](March 9, 1944); B.I.P.C. 14:249.

A simple volumetric apparatus for measuring the transmission of gases through sheets and films is described. The sensitivity of the apparatus is shown to be approximately 0.019 cc. per 100 sq. in. per 24 hours for a 24-hour period. The permeability of ethylcellulose to air was found to vary with temperature and humidity conditions. In dry air the transmission rate at 36.7°C. was more than double the rate at 1°C. Humidity had the effect of decreasing air transmission through ethylcellulose, whereas it markedly increased the transmission rate through regenerated cellulose.

410. Todd, H. Russell. Gas transmission measured by volumetric method. Modern Packaging 18, no. 4:124-6, 160(Dec., 1944); B.I.P.C. 15:174.

Although not identical in text, the present article offers a description of the volumetric gas transmission method very similar to the one given in the above abstract.

411. Transparent films-control of porosity. Techniques d'Emballage no. 2:39, 41, 43(April, 1954); Packaging Abstr. 11:761.

A method of testing the porosity of seals in transparent films is described. Air at a known pressure is passed into a bag of the plastic film, which is immersed under a known depth of water. The air pressure in the bag is progressively increased until the first air bubbles appear in the water. The air pressure at this point is a measure of the porosity of the seal. Some specimen results are given for different films sealed at different temperatures, times and pressures.

412. Treseder, A. R. Converting trends and their significance to the papermaker. Australian Pulp & Paper Ind. Tech. Assoc., Proc. 5:79-89; discussion:90-1(1951); B.I.P.C. 22:832.

Examples of improvements in converting machinery (carton machine, rotary wrapper printer and bag machine) are quoted to show the need for greater uniformity in the properties of paper and board. A graphical method of quality control is suggested as a means of achieving greater uniformity; the need for periodic operating surveys and tests of field performance is emphasized.

413. Turco switches to bags. Soap Chem. Specialties 31, no. 9:45-7 (Sept., 1955); B.I.P.C. 26:112.

A new development in the packaging of detergents and cleansers for industrial use is the Kard-O-Pak, a bag of heavy-duty calendered stock with a polyethylene lining. The lined bag stands flat like a carton, has the flexibility of a bag, and protects the contents from grease seepage, air and moisture deterioration, and caking; in addition, it is adaptable to high-speed filling.

414. Turina, S. Uses and methods of testing permeability of (plastic) foils and treated papers. Zaštita Materijala 4, no. 11:362-5(1956); Rev. Current Lit. Paint, Colour, Varnish and Allied Ind. 30, no. 180:504(June, 1957); Packaging Abstr. 14:751.

The properties of various types of plastic films and treated papers are discussed. Methods of testing permeability are given. The permeability of polyethylene and polyvinyl films has been measured by a Schalen method for water vapor, carbon dioxide, etc. A new quantitative method for the permeability for water has been devised, in which the plastic sheet is used as a membrane in an electrolytic cell. Data for the permeability for polyethylene and polyvinyl chloride sheets are given.

415. Union Bag & Paper Corp. Lined paper bags for toxic chemicals. Chem. Eng. 59, no. 1:186(Jan., 1952); B.I.P.C. 22:435.

A specially constructed paper bag has been developed to package toxic chemicals. It is of duplex construction and has an inner liner of Unithene, a polyethylene-coated kraft paper which offers adequate resistance to the contents as well as to the penetration of outside moisture.

416. Union Bag & Paper Corp. Railroads approve paper bags as grapefruit carriers. Packaging Parade 20, no. 228:82, 84(Jan., 1952); Southern Pulp Paper Mfr. 15, no. 1:86(Jan., 1952); Food Eng. 24, no. 2:162(Feb., 1952); B.I.P.C. 22:435.

The railroads have authorized the use of a specially developed paper bag for the shipment of grapefruit. It is made from three layers of wet-strength paper and is suitably perforated to permit ventilation of the contents. Test shipments show that this type of container provides protection comparable to that provided by conventional types, and its use results in substantial savings in container costs.

417. Union Bag & Paper Corp. Revolutionary new paper bag has "window" of cotton mesh. Packaging Parade 15, no. 179:37(Dec., 1947); Paper & Twine J. 21, no. 10:10, 29(Dec., 1947); Am. Paper Converter 21, no. 12:13(Dec., 1947); B.I.P.C. 18:325; Packaging Abstr. 5:85.

A new paper bag, called "Vent-Vu," and designed for use in prepackaging bulk fruits and fresh vegetables at the shipping point, is made of at least two plies of wet-strength paper with a window of cotton mesh securely bonded between the plies by a special moisture-resistant adhesive. Handles of specially treated creped kraft paper of great tensile strength are also bonded to the bag if desired. High speed machines make the bags and print them in as many as three colors. The containers have square bottoms and, therefore, stand upright on the packaging machines, nest well, and adapt themselves to mass display.

418. Union Bag & Paper Corp. Special coating makes multi-wall bag 'non-skid.' Packaging Parade 21, no. 243:228(April, 1953); Chem. Processing 16, no. 4:119(April, 1953); B.I.P.C. 23:668.

A nonskid multiwall bag has been developed; a special coating applied to the face and back of the bag during its manufacture give it an extremely high skid resistance. In laboratory tests with a tilt table the minimum slide angle for the nonskid bag was found to be 42°.

419. Union Bag's garbage can liners may open big new kraft market. Paper & Paper Products 96, no. 13:5-6(Jan. 5, 1955); B.I.P.C. 25:469.

A garbage-collection system using two-ply kraft bags melamine-resin treated for wet strength as liners for conventional garbage cans has shown a number of important advantages, including a reduction in the number of men required on collection crews and improved sanitation. Field tests with the bags are reported to have proved that the bags stood up under all types of refuse, severe cold, and heavy rain.

420. U. S. Department of Agriculture. USDA tests multiwall bags for shipping citrus fruit. Pre-Pack-Age 3, no. 6:31(Feb., 1950); Packaging Abstr. 7:449.

Multiwall bags were not as satisfactory as wirebound boxes in that moisture condensed in the unperforated bags and temperature drops during cold storage were comparatively small.

421. U. S. Department of Agriculture, Production Marketing Admin. Multiwall bags as shipping containers for citrus fruit. Washington, D. C. 1950. 1 p.; Packaging Abstr. 7:513.

Sales are not retarded by shipping citrus fruit in diphenyl-treated multiwall paper bags. Perforated bags show less moisture condensation, and stickiness due to juice from split oranges spreading through the condensed moisture, than solid bags. In transit, the cooling rate of fruit in wirebound boxes is greater than in solid bags. No cooling tests were made with perforated bags.

422. U. S. Industrial Chemicals, Inc. Pyrenone insecticides. Fibre Containers 36, no. 1:102(Jan., 1951); B.I.P.C. 21:470.

Pyrenone insecticides (10 parts of piperonyl butoxide and 1 part of pyrethrins) have been found effective in preventing insects from entering treated containers for periods ranging upward to one year. Paperboard, multiwall kraft bags, and wax papers have been treated; the insecticides are offered in powder or slurry form for clay coatings, in emulsifiable form for application from calender stacks, and in oil form for incorporation in molten waxes or other coatings, where compatible. Pyrenone insecticides do not involve toxicological hazards, skin irritations, or unpleasant odors; to date there has been no indication that their use has resulted in the development of resistant strains of insects.

423. U. S. National Bureau of Standards. Grocers paper bag recommendations published. Converter 18, no. 2:10-11(Feb., 1944); B.I.P.C. 14:212.

The text of the Simplified Practice Recommendation R42-43 is given, covering grocers' paper bags and containing the amendments necessitated by the recent Limitation Order L-261. Thirty-five sizes (three of which are satchel-bottom sacks) are listed. Basis weight, grade of paper and dimensions for each size of bag have been added. The method of measuring and computing the capacity of the bags is indicated in each case.

424. U. S. National Bureau of Standards. A study of test methods for the purpose of developing standard specifications for paper bags for cement and lime. Technologic Paper No. 187. Washington, D. C., The Bureau.

The development of special service tests for such bags are described and specifications given which include the ordinary properties and conditions relating more especially to the actual uses of the bags.

425. U. S. War Production Board. Container Coordinating Committee. Manual for inspection of damaged shipments. Converter 17, no. 4:8-9(April, 1943); B.I.P.C. 13:372.

The information concerning fiberboard shipping boxes, fiber drums, and textile bags and multi-wall paper shipping sacks from the recently issued manual is reprinted. It is to be used in the preparation of reports on damages to shipments of war materials and supplies. Diagrams are included.

426. U. S. War Products Development Section. Pulp and Paper Division. Moisture vaporproof wrapping. Fibre Containers 28, no. 11:69-70(Nov., 1943); Converter 17, no. 11:22(Nov., 1943); B.I.P.C. 14:146.

The attention of the pulp and paper industry is drawn to the very urgent need of the armed forces for a wrapping material which will perform certain functions. Two grades are involved: one a moisture vaporproof barrier in the form of a bag where a desiccant is included to maintain a relative humidity of 20% or less (used for packaging certain electrical and radio equipment, delicate instruments, etc.); the other is a moisture vaporproof barrier, also in the form of a bag, where corrosion is not a factor. The detailed requirements for both grades are given.

427. The use of paper bags in the cement and fertilizer industry. Wochbl. Papierfabrik. 66, no. 7:126-7(Feb. 16, 1935); B.I.P.C. 5:214.

The strength of bag papers has been augmented to such an extent that they now compete successfully with jute bags for shipping cement and fertilizers, such as Thomas meal and potash. Bituminous paper must be used in the case of hygroscopic substances. Bursting tests revealed that the paper bags were equal, sometimes even superior, to jute bags. So far only kraft pulp has been used in their manufacture.

428. Usmanov, K. U., and Pak, Y. V. Relation between sorption and swelling of cellophane. Doklady Akad. Nauk S.S.S.R. no. 12:25-8(1953); J. Textile Inst. 47, no. 1:A57(Jan., 1956); Packaging Abstr. 13:293.

The relation between swelling and water sorption of cellulose film was studied by determining the sorption and desorption isotherms at 25°C. gravimetrically by means of a spring quartz balance. The elongation in water was studied in longitudinal and lateral directions to the machine direction.

The lateral elongation was almost twice the longitudinal elongation; this anisotropy is apparently due to the difference in chain orientation in various directions. The sorption and desorption and the elongation curves had hysteresis loops indicating a change in the structure of cellulose during water sorption.

429. VPI goes to war. Modern Packaging 24, no. 11:92-5(July, 1951); B.I.P.C. 21:863.

Vapor-phase inhibitive papers promise to find extensive use as anti-corrosion agents in packing rifles and other ferrous armament materials because they provide excellent protection and eliminate the need for time-consuming cleaning operations before use. Formal government approval has recently been given to MIL-P-3420 Specification for Packaging Material, Corrosion Inhibiting, Volatile Type. The proposed vapor method for preserving and packing rifles employs individual laminated corrosion-inhibitor bags lined with VPI-coated kraft paper. Preliminary tests have shown the efficiency of this method for rifles and other iron or steel products, and the successful industrial uses of VPI paper provide additional evidence of its effectiveness.

430. Valderrama, Rafael Albarracín, and Fernández, Francisco Lechuga. Waterproof compositions for kraft paper bags. Spanish patent 214,795 (April 28, 1955); C.A. 50:3762.

Low- and high-melting asphalts blended with pine rosin and hydrocarbon solvent form moistureproof, sprayable coatings for kraft fiber sacks.

431. Verdcourt, Bernard. Packaging parasites. PATRA J. 10, no. 1: 6-11(Jan., 1947); B.I.P.C. 18:22.

The use of insecticides in the packaging industry is of fairly recent origin and their usefulness is conditioned by several limitations. An insecticide that is to be incorporated in a paper or board must have a high stability, must generally be nontoxic to higher animals, have no unpleasant odor or other disagreeable properties, and must be capable of easy application to the packaging material. The new compounds, DDT and Gammexane, act as contact as well as stomach poisons, so that the insect does not have to eat a large quantity of the treated material before being killed. Normal cardboard packages are reasonably resistant to some insects for periods of several months, provided that they are thoroughly sealed. The slightest crevice or hole allows entry and most packages examined show such means of entry at their sealed ends. The package is weakest at the corners and insects will bore at these places. Complete sealing with wax proves effective and is less expensive than a complicated laminate. It is quite useless to employ such a laminate in the manufacture of a package if the ends are poorly sealed. DDT-treated paper bags, boxes, sacks, and packages have successfully resisted the attacks of such renowned pests as the cadelle. DDT retains its toxicity for a considerable time and, since the shelf life of most packages today is fairly short, it would appear to be very useful.

However, it is distinctly toxic to human beings when taken by mouth in quantity, so that laws have been passed in America covering the minimum amount which may be left on fruit before sale. Delicate foodstuffs are distinctly tainted if packed in packages treated with solutions of crude Gammexane or DDT. Not all insect infestation is caused by penetration of insects from the outside, although infestation originating from the material itself is surprisingly small. Certain aliphatic halogen compounds and esters have recently been used for fumigating the food prior to packing. The relation to the food laws of the use of insecticides in the packing of foods is a subject which needs investigation before unrestricted use can be made of them. The new insecticides can certainly be of value to the packaging industry; they will, however, not reduce the care required in ensuring that the package is structurally sound.

432. Voigt, W. Apparatus for measuring the adhesion of plastic films. Kunststoffe 44, no. 5:199(1954); Brit. Plastics Federation Abstr. 9, no. 6: 554(June, 1954); Packaging Abstr. 11:863.

An apparatus for measuring the adhesion of plastic films to the material coated is described with a diagram.

433. Voigt, W. New method of measuring the mechanical behaviour of high polymers. Kunststoffe 46, no. 2:58-9(1956); Brit. Plastics Federation Abstr. 11, no. 3:218(March, 1956); Packaging Abstr. 13:378.

A new machine for determining the tensile strength of thermoplastic films is described with diagrams. This can be used under constant load, constant rate of loading and constant rate of extension. The temperature can be varied.

434. Waack, Richard, Alex, N. H., Frisch, H. L., Stannett, Vivian, and Szwarc, Michael. Permeability of polymer films to gases and vapors. Ind. Eng. Chem. 47, no. 12:2524-7(Dec., 1955); B.I.P.C. 26:384; Packaging Abstr. 13:190.

The permeabilities of a number of polymer films to oxygen, nitrogen, carbon dioxide, methyl bromide, and ethylene oxide have been measured using high vacuum technique. The effect of temperature, pressure, and film thickness on the permeability constant has also been investigated. The permeation of gases and vapors through polymer films appears to be diffusion controlled. The permeability constants for any gas vary enormously with the nature of the polymers.

435. Wall, D. Paper sacks. Canning and Packing 24, no. 283:12-13 (July, 1954); Packaging Abstr. 11:892.

The general characteristics and advantages of paper sacks are stated with an indication of some special uses.

436. Wall, Douglas. Paper sacks their uses and advantages. J. Inst.

Packaging 2, no. 24:453-4, 456, 458; discussion:458, 460(1954); B.I.P.C. 25:564.

The advantages of the multiwall sack include the fact that it is an inexpensive clean hygienic nonreturnable container, the contents are well protected, the sack promotes better packaging layouts, general handling and stacking are facilitated, and the sacks are excellent as an advertising medium. Multiwall sacks find use in packaging rock products, fertilizer, chemicals, plastics, animal feed, and foodstuffs.

437. Watkinson, D. Package testing. J. Inst. Packaging 3, no. 25: 48-54; discussion: 54(4th quarter, 1954); B.I.P.C. 25:564.

The testing of materials and packages to determine the performance of a package under conditions of transport are discussed. The application of tests for tensile, bursting, tear, and dynamic-tensile strength, and folding endurance to bagmaking and wrapping paper, thick papers, and boards is covered, as well as tests for water, water-vapor, grease, and gas resistance. Equipment used for strength tests includes drop, drum, inclined-plane, compression, and vibration testers.

438. Watson, Charles, 3rd. Packaging of dehydrated foods. Paper Mill News 65, no. 43:30(Oct. 24, 1942); Converter 16, no. 10:6-7(Oct., 1942); Shears 60, no. 597:11(Sept., 1942); Paper Trade J. 115, no. 14:55(Oct. 1, 1942); B.I.P.C. 13:120.

The final success of dehydrated fruits and vegetables depends upon three equally important factors—namely, the preliminary treatment of the products, the actual dehydration process, and the packaging of the finished product. Unless containers as foolproof as vacuum-packed tins are developed, the future of the industry beyond the present emergency is not assured. Recently, the use of a 3-in-1 container (utilizing specially treated paper, fiber, and wood) was permitted for Army and Navy needs. The new package is made of laminated paper with two or more sheets of paper and lead foil fastened together with adhesive coatings that make them waterproof. Five gallons of dehydrated food are placed inside a laminated bag of glassine. This is placed into a moistureproof and insect-resistant heavier bag, whose inside layer is vaporproof cellophane, the outside being a kraft paper laminated to lead foil. The main bag is placed in a weatherproof carton, and two of these cartons are placed in a single shipping case which may be weatherproof solid fiber or a wooden box. This type of package is only specified for fruits, vegetables, and soup mixes.

439. Weiner, Howard M. Performance testing of flexible barriers. Modern Packaging 28, no. 2:156-8, 226, 228, 230(Oct., 1954); B.I.P.C. 25:217.

Military specifications which contain a provision for low-temperature tests are discussed. Specifications JAN-P-117 for interior packaging bags and MIL-P-116B for methods of preservation incorporate a low-temperature phase in a cyclic performance test, and the latest specification on MIL-B-131B for water-vaporproof barrier materials contains three low-temperature tests (a cyclic performance test, a flex test at -20°F., and a test for resistance to vibration at -65°). The background and development of these tests are outlined, with particular reference to the Gelbo flex test. An investigation which was started recently deals with methods for testing seam strength at low temperatures which appears to be the prime factor involved. Since the tests are still in progress, few definite conclusions can be drawn. The present indications are that the majority of heat-sealable barriers with satisfactory seam strength at elevated and room temperatures also have satisfactory seals at -25, -40, and -65°. Seam strength of aged materials decreases at low temperatures, so that for barrier materials which have been stored for considerable periods a provision should be included in the specifications for testing seam strength at low (possibly at -65°) and elevated temperatures.

440. Welsh, Hewitt S. Toughness: new index for paper. Modern Packaging 31, no. 9:221-2, 225, 288, 292(May, 1958).

Clupak stretchable paper multiwall bags and other bag constructions were tested by the drop test. Correlation between flat drop performance and machine-direction stress-strain toughness of multiwall bag construction was shown. There is a close connection between the energy-absorbing capacity of the paper and the behavior of the bags in use. Bag performance as far as it is influenced by paper strength can be predicted from simple stress-strain analysis in the form of toughness. In a series of field shipments testing the performance of Clupak paper bags with control bags containing 20% more paper, the breakage incidence of the Clupak bags averaged 4/10ths of 1%, while the breakage of the heavier control bags averaged 1.5%. In further tests, the basis weight of Clupak bags was reduced as much as 30% with performance comparable to bags of standard weight. In another field test, the breakage figure for the Clupak bag was only two, while the breakage for the control bags was six.

441. Wet strength paper markings specified. Converter 17, no. 11:28 (1943); Packaging Abstr. 1:29.

All wet-strength paper used in the manufacture of sacks must be distinctly colored, stained, printed or marked for identification purposes with longitudinal stripes, at least 1/8 in. wide and spaced not less than 2 in. nor more than 10 in. centers across the paper width.

442. Wiggins, R. S. Carry water in a paper bag? Du Pont Mag. 48, no. 6:24-6(Dec., 1954-Jan., 1955); B.I.P.C. 25:380.

Products made by coating du Pont's "Alathon" polyethylene resin to paper, paperboard, aluminum foil, and cellophane are described. The packaging materials thus produced are flexible, nontacky, and resistant to grease and moisture.

443. Wobble, H. J. The use of K. B. asphalt emulsions in the paper industry. Papier-fabr. 29, no. 22:333-5(May 31, 1931); B.I.P.C. 1(11):18.

K. B. emulsions permit the use of asphalt in the form of an aqueous emulsion which is either incorporated into the fibrous pulp or applied immediately after sheet formation between the individual layers of paper and cardboard. The chief products which can be manufactured with K. B. emulsions include waterproof wrapping and bag paper.

444. Wooding, W. M. Surface bonding test for cellulosic films. Paper, Film and Foil Converter 30, no. 3:23(March, 1956); B.I.P.C. 26:659.

A quick and simple test to evaluate the effectiveness of an anchor-resin coating on the surface of regenerated cellulose film, called the wax streak test, comprises marking the film with a wax pencil or crayon, immersing it in water, and rubbing the marks with the finger. Film without anchor-resin treatment loses the crayon streaks; the greater the bonding ability of the resin treatment, the harder it is to rub out the crayon.

445. Younger, John O., and Sargeant, James A. Evaluating multiwall bags. Modern Packaging 28, no. 3:157-62, 230, 232(Nov., 1954); B.I.P.C. 25:309; Packaging Abstr. 12:94.

The Quartermaster Food and Container Institute, working with Container Laboratories, Inc., has been making studies and laboratory tests for the purpose of establishing criteria for the evaluation of performance of multiwall shipping sacks and to develop data for the design of multiwall sacks to resist specific transportation and storage hazards. In one section of the work, test data were developed on the physical properties of the component materials used in the sack construction, and in the other section completely assembled, filled, and properly closed sacks were examined. The sacks tested included basic flat-tube and gusseted styles made from five and six kraft plies, plies treated for wet strength, and a lamination of polyethylene film on some of the plies. In all samples the bags were filled with 50 pounds of dried beans; all bags had a textile inner liner except one, which had a five-ply kraft liner. The test procedure is described and covered exposure to various weather types and hazards of transportation and handling. It is concluded that conditioning for tropic and desert weather reduces performance expectations, water-immersion conditioning has proved to be too severe, field tests in climates paralleling those simulated in this investigation should be undertaken, and a drop-test procedure remains the best criterion for evaluation of multiwall shipping sacks.

446. Yowell, L. Q. New adhesive offers promise to paper industry. Am. Paper Converter 22, no. 11:15(1948); Packaging Abstr. 6:58.

Permakote is a liquid surface coating with a synthetic rubber base. It is claimed to be resistant to abrasion, heat and cold (between -80° and 300°F.), alkali and acid, wind, rain, dampness, sun, dust, salt spray, smoke, solvents, fumes and fiber (when set). A sheet of kraft paper, coated with Permakote, has been crumpled indefinitely in tests without the paper breaking. The property makes the adhesive useful in the manufacture of bags. Whether printing can be done on Permakote-treated paper is unknown, because of the oils in the ink. It is thought that Permakote could be applied to packaging, e.g., for paper and plastic containers, food package coating, and waterproofing paper bags.

447. Zoebelein, H. Determination of the water vapor permeability of films. Kunstoff Rundschau 4, no. 2:47-8(1957); Brit. Plastics Federation Abstr. 12, no. 4:304.

A method is given for determining the water-vapor permeability of films with diagrams of the apparatus used.